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ABSTRACT

British developments in science and mathematics education at all levels from elementary to university, including teacher training, are announced in this newsletter. Notes on professional appointments, instructional systems, curriculum developments, and activities of professional societies are included. Additional general educational activities in Great Britain are also noted--including reports on teacher education and training, curriculum diffusion, activities of educational research organizations, and professional committees. Abstracts of the British educational press of interest to science teachers are included in the newsletter for the first time in this issue. Summaries of science and mathematics education activities in Australia, Ghana, India, Jamaica, Malaysia, New Zealand, Nigeria, Swaziland, Thailand, Uganda, United States of America, and Zambia, as well as a report on a UNESCO seminar on science education in the Arab states and a calendar of international science education events, are included. (AL)

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THE BRITISH COUNCIL

SCIENCE EDUCATION NEWSLETTER

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SEN No 18

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EDITORIAL

This issue of Science Education Newsletter contains a new feature - Science Education Abstracts. Often critical appraisals of current developments and similar key articles analysing science education matters appear in the periodical literature and may as such go unnoticed by workers in the field. The purpose of this new feature is to extract, abstract and thus draw attention to major articles of this kind which will be of interest to many science educators all over the world. It is not intended to provide a comprehensive service of this kind, but simply to highlight important aspects of professional discussions and growth points as reflected in the current periodical literature.

The contents of SEN 18 are presented in a slightly reorganised form which we hope will make for easier use in that a more precise subdivision of items has been used. An index covering issues Nos 13-18 will be issued with issue No 19.

ACTIVITIES IN BRITAIN - SCIENCE

1. Some developments in Rural and Environmental Studies being carried out in Wiltshire

For a great many years Wiltshire has pursued a policy of encouraging and developing Rural and Environmental Studies in schools at all levels of education. Qualified Rural Studies teachers are active in the County's Secondary Schools.

The most recent development is the acceptance by the Schools Council of the first Advanced Level Environmental Studies Syllabus in the county.

There is at Trowbridge, Palmer Gardens a $2\frac{1}{2}$ acre Demonstration Garden and Natural Science unit for schools, while at Oxenwood there is a residential Field Studies Centre.

Activities in these subjects are directed by the County Rural Studies Adviser. The County has many visitors from overseas who share an interest in these subjects.

Wiltshire has produced several reports during the last few years, including the following titles:-

A Report on Curriculum Developments in Rural Studies
The Place of Rural Studies in the Comprehensive System
Rural Studies and the Nuffield Foundation Science Teaching Project.

2. Geography for the Young School Leaver

The Schools Council Curriculum Development Project, Geography for the Young School Leaver, was established in September 1970 and will run for 3 years. The Project is based at Avery Hill College of Education, Avery Hill Road, London SE9. The Project is concerned with pupils of below average to average ability between the ages of 14 and 16. Geography with its great range of content and techniques has much to offer at this level, whether it be taught as a separate subject or as part of an inter-disciplinary course. These pupils may be following either CSE or non-examination courses. The raising of the school leaving age will demand a reconsideration of some of the existing schemes. The main aims are

2.1 To examine successful work which is being undertaken at present with relevant groups of pupils in 14-16 age group.

2.2 To define the contribution that geography can make to the particular educational needs of these pupils.

2.3 To investigate the skills which these pupils can master in pursuit of this work.

2.4 To produce schemes of work which can be used in either a subject or inter-disciplinary framework.

The team will consider the basic factors which affect the development of these pupils. They will make a detailed study of present curriculum developments. Close contact with teachers, schools, advisers and teachers' centres will be made throughout the project. A review will be made of the relevant teaching resources which are at present available to schools. Questionnaires will be circulated to establish a picture of current methods and approaches being used in England and Wales. A study of the examination of geography at the CSE level will be undertaken. The schemes of work to be developed will allow for varied activities to accommodate the range of skills and interests of these pupils. They will be staged within the context of the environment of local, national

and world levels. The materials will be tested in schools throughout England and Wales. In-service courses and conferences will be held to disseminate the findings of the Project. The first newsletter of the Project was issued in July 1971. The co-directors of the Project are Rex Beddis, Senior Lecturer in Geography, Avery Hill College of Education, Tom Dalton, Senior Lecturer in Geography, Avery Hill College of Education, The Research Officers are Trevor Higginbottom and Pamela Bowen of Avery Hill Teacher Training College. Further information can be obtained from Mr Trevor Higginbottom at the College.

3. Biology: An Environmental Approach

This consists of a series of five books adapted from "High School Biology" (the 'Green Version') by permission of Biological Sciences Curriculum Study, Boulder, Colorado. The titles are:-

The World of Life: The Biosphere	£1.35
Diversity Among Living Things	£1.35
Patterns in the Living World	£1.50
Looking into Organisms	£1.50
Man and his Environment	£1.90.

Publisher: John Murray.

The 'Green Version' referred to above has been adapted for use in Australia, New Zealand, Japan, Puerto Rico, the Philippines and other countries.

The present adaptation for Britain and other parts of Western Europe has been prepared under the supervision of Professor Elizabeth Perrott and a team based on Stirling University.

These five books are not a rigid 'course'. They may be read singly or taken together. They can be used as revision materials for many examinations in the biological sciences at Secondary School level - as well as providing useful reference books for liberal studies. Special tests, largely objective in style, are being developed for use with each of the books.

The emphasis of the series is on ecology and ways of living.

Although, as mentioned above, this series is an adaptation for Britain the books do not deal solely with British ecology, British species etc. A more universal approach is adopted.

The books contain many clear diagrams and colour plates.

4. Association for Science Education

4.1 Report on the Association's Annual Conference

The Annual Conference of the Association for Science Education was held at the University of Stirling, Scotland from 28 December to 31 December 1971. Approximately 600 people were resident at the Conference and between 100 and 200 day visitors attended. Of the Conference members, about 60 were from overseas and represented 18 different countries. The British Council Science Education Section and CEDO Curriculum Division jointly organised an exhibition of science education material and two overseas sessions. The exhibition of the material included books, science teachers' journals and apparatus from overseas.

The first overseas session was chaired by Dr G Howell, Head of Science Education Section of the British Council. The two main speakers were Mr A J Mee, an ex-Scottish HMI, who spoke on the adaptations of Scottish science courses in overseas countries, and Mr C Crellin, UNESCO Science Adviser in the Philippines, who gave an up-to-date picture of the progress in curriculum development in that area.

The second session was chaired by Mr D G Chisman, Deputy Director of the Curriculum Division of CEDO. Mr A Osiyale from Nigeria gave a talk on developments in science teaching in Nigeria and also information on the development of the primary science programme in Africa (SEPA). (See SEN 16:25, 18:22). Mr R M Garrett then spoke on new developments and problems facing Colombia in South America in developing their school science programme.

Apart from the special overseas sessions, all the overseas visitors participated fully in the general Conference programme. Of particular interest in this programme were a "teach-in" on integrated science. Participating in this "teach-in" were Mr L Ennever, Director of the School Science 5-13 Project; Dr M Gibbons, Lecturer in Liberal Studies in Science, University of Manchester; Dr D J Jenkins, Lecturer in Integrated Science, University of Stirling; Mr B Mowl, Joint Director of the Schools Council Integrated Science Project and Mr W Ritchie, an HMI for Scotland. Also, a discussion entitled 'School-based and college-based activities for student teachers' led by Dr J Haysom and Dr C Sutton, co-Directors of the Science Teacher Education Project, was very well attended and gave up-to-date information on the progress of this very interesting project (see SEN 18:16).

Complementing the formal programme was an extensive exhibition of books and apparatus mounted by the various publishers and school science equipment manufacturers.

4.2 New subscription rates

The Association for Science Education has announced new subscription rates which will take effect from 1 October 1972. They are as follows:

Ordinary member	£5.00
Joint members (husband and wife)	£6.00
Overseas member	£4.00
Student Associate	£2.50
Transfer of student associate to ordinary member or new ordinary member in first year of teaching	£2.50

The ASE would be particularly grateful if people who are already members with the Association and paying their subscription by Banker's Order would note these changes and alter their Bank instructions accordingly.

5. The Chemical Society

The Education Division of the new Chemical Society, formed by the merger of the Chemical Society, the Royal Institute of Chemistry, the Faraday Society and the Society for Analytical Chemistry, held its inaugural meeting at University College, London on Saturday 19 February 1972. The inaugural address "Why Teach Chemistry" was given by Professor D J Millen of University College London to an audience of some 220 members.

The basic aim of the Education Division is to involve teachers, lecturers and industrialists in discussions and projects designed to foster development in chemical education. There will be subject groups in each of the basic areas - assessment, educational techniques and the curriculum. These groups will organise meetings to exchange views and ideas and arrange workshop sessions concerned with such topics as curriculum reform, programmed learning, objective testing and the use and presentation of educational aids. The Division will encourage regional activities in these and other subjects and will also organise meetings nationally. Participation in educational development is what the Division is really about.

An Education Division Council has been set up under the Chairmanship of Dr M Frazer, who will shortly take up his new appointment as Professor of Chemical Education at the University of East Anglia in succession to Professor J Halliwell. (See SEN 18.8). This Council has representatives from Industry, Polytechnics, Universities and School Teaching.

The meeting on 19 February 1972 proceeded to set up three six-man Committees to investigate possible initiatives in the fields outlined above. The Chairmen and Secretaries of these three working Committees are:-

CURRICULUM DEVELOPMENT	Chairman:	Professor A K Holliday, University of Liverpool
	Secretary:	Dr D E Billing, School of Chemistry, Thames Polytechnic
EDUCATIONAL TECHNIQUES	Chairman:	Professor L J Haynes, The Open University
	Secretary:	Dr R B Moyes, Department of Chemistry, University of Hull
ASSESSMENT	Chairman:	Mr A W Jeffrey, Scottish Education Department
	Secretary:	Dr G M Seddon, Chemical Education Department, University of East Anglia

6. Chemical Education at the Tertiary Level

This was the title of a Symposium held at the University College of Swansea as part of the Annual Meeting of the British Association for the Advancement of Science in association with the British Committee on Chemical Education on 7 September 1971. The Symposium, which was chaired by Professor C C Addison of the University of Nottingham ranged widely over the interfaces of modern developments in chemical education. The principal papers were as follows:

GCE Examinations - New aims and objectives	Professor A K Holliday, University of Liverpool
The objectives of tertiary chemistry courses	Dr R Muskill, University of Liverpool
Education through chemistry	Professor N N Greenwood, University of Leeds
The integration of school and university chemistry	Professor D W A Sharp, University of Glasgow

Practical work - Why?	Dr T J Stone, University of Warwick
A new course	Mr W K Wild, Polytechnic of North Staffordshire

A report of this Symposium can be obtained from Dr M D Robinson, Secretary to the British Committee on Chemical Education, The Chemical Society, Burlington House, Piccadilly, London W1V OBN.

7. Developments in Tertiary Chemical Education

This was the title of a three-day conference arranged by the School of Chemistry of the Thames Polytechnic from 13-15 December 1971.

The aims of the conference were to provide participants with an over-all view of recent and innovation in tertiary chemical education, to indicate current growth areas by the presentation of research findings, to enable participants to circulate their ideas, to stimulate interest and encourage individual participation in the discussion of new developments and to enable participants to examine learning programmes for tertiary level chemistry teaching. Four review lectures were given which covered the areas of objectives, curriculum, methods of assessment and educational techniques. There were given by Dr R M Beard of the University Teaching Methods Unit, University of London; Mr R Cox, University Teaching Methods Unit, University of London; Professor L R B Elton of the Institute of Education & Technology, University of Surrey and Dr A K Holliday of the Department of Inorganic Physical Industrial Chemistry, University of Liverpool, respectively. Other lectures covered the use of modern media and audio-visual techniques in the teaching of chemistry and the relationship of tertiary science courses to the needs of industry as well as the combination of education and chemistry in concurrent degree courses. This meeting is the third of its kind in the United Kingdom recently, the previous two being the Symposium on Chemical Education at the Tertiary Level held as part of the Annual Meeting of the British Association for the Advancement of Science at the University College of Swansea on 7 September 1971 (see SEN 18:6); and the Symposium on Chemical Education held at the Annual Meeting of the Royal Institute of Chemistry/Chemical Society at Brighton in March 1971. A further meeting will form part of the Chemical Society Annual Meeting at Manchester in April 1972.

8. Professor of Chemical Education, University of East Anglia

A new Professor of Chemical Education at East Anglia has been appointed in succession to Professor Halliwell who has retired; he is Dr M J Frazer, who was formerly Head of the Department of Chemistry, The Northern Polytechnic, London, a post to which he was appointed in 1965.

9. Leicester University - PhD in Chemistry with Graduate Certificate in Education (See SEN 15:11)

The primary aim of this new degree course leading to the degree of PhD (in chemistry) with Graduate Certificate of Education, is to ensure the flow into the teaching profession of a limited number of highly qualified graduates with a research training.

The course structure includes a research project in chemistry and an educational component. The time allocation for the whole course is 3 years. The educational component requires about 60 days in schools and 90 other days spread over the first $2\frac{1}{2}$ years and one day per week of term time, except when block teaching practice intervenes. Each student undertaking the course will have

2 supervisors appointed by the Senate, one from the Department of Chemistry and one from the School of Education. Each student will select his research project in consultation with his supervisors. The student is required to submit a PhD thesis concerned exclusively with his research project. At the oral examination the examiners will take the Graduate Certificate of Education work into account. The educational component will be assessed throughout the course. Applications are invited by the University of Leicester from the following:

9.1 Final year students about to complete an Honours Degree or a General or Combined Honours Degree including chemistry component.

9.2 Graduates with Honours Degrees or those holding the equivalent of graduate honours qualifications who are at present in industry or who are already in the teaching profession, but do not hold a Graduate Certificate of Education.

Before admission to the course it is necessary the candidate should satisfy the University that he holds a degree with first or second class honours or a higher degree of Leicester University or of another University recognised by the Senate for this purpose or hold a qualification recognised by the Senate as equivalent thereto, (eg a GRIC to an appropriate standard).

This course might be of interest to prospective overseas applicants and we understand that the University at present is wishing to consider people who would require a course starting in 1973 going on to 1976, rather than for the coming October 1972.

10 Inter-University Biology Teaching Project

This project commenced in October 1969 and was set up to evolve new methods of teaching biology at university level. Five universities are participating and these are Glasgow, Birmingham, London (Queen Elizabeth College and Chelsea College), Bath and Sussex. The overall policy is determined by an executive committee whose Chairman is Professor O E Lowenstein Birmingham University. The overall objectives of the project are to widen the range of materials available to pupils and teachers and their methods of presentation. In addition to aiding understanding and learning it is hoped that the use of self-instruction will achieve a saving in time and man-power. Three different types of courses are envisaged:

10.1 Bridge courses intended to span the gap between knowledge acquired at school and that needed for first-year university work, for example, a developmental biology course which is being produced at Glasgow University.

10.2 Technique courses concerned with the acquisition of the essential skills necessary to all biologists at various stages in their rural course, eg "electricity for biologists" being produced at Birmingham University.

10.3 Main courses which are intended for use at any stage of the University biology course, eg enzymes.

The courses are relatively short and therefore could be incorporated in the existing programme without necessitating undue reorganisation. Printed matter will be a prominent feature in the end products of the project. These will take the form of:

10.4 Student books. These should be cheap and expendable and will include a brief outline of the course, questions, response sheets, notes, references and a limited number of illustrations.

10.5 Tutors guides. These will provide a background to the course particularly regarding methods of teaching and presentation. Also necessary technical information and suggestions regarding methods of implementation etc.

10.6 Ancillary guides, ancillary materials such as charts, flow diagrams and possibly some additional reading matter. Audio-visual aids will include audio tape with 2 x 2" 35mm slides to be synchronized with the tape. 8mm film loops and at least one short 16mm sound film. These have all the optional extras thus reducing the cost if necessary.

The present position is that the materials produced by universities are now undergoing or completing their final trials and the first of them should appear on the market in approximately a year's time. It is at present envisaged that the cost of a single 12 hour module would be in the region of £40 excluding optional films. The coordinator of the project is W H Dowdeswell, Bath University of Technology, School of Education, Northgate House, Upper Borough Walls, Bath, Somerset.

11. University Teaching Methods Unit (See SEN 13:21)

In a recent information sheet issued by the Unit, which is within the University of London Institute of Education, states that it proposes to accumulate information on methods of teaching and testing, to develop new teaching methods and to devise more effective methods of communicating new ideas to teachers in the colleges. Since the University of London has provided the Unit with closed circuit television facilities it is able to conduct experiments in micro-teaching and record sessions of teaching for viewing and discussion by the participants or by other teachers.

The Unit's other activities include the running of a course for about two hundred new lecturers in the autumn and a conference early in the year for between one to three hundred senior staff on some topic of general interest. Some topics of current and proposed research are:-

A comparison of live and relayed lecture effectiveness; linguistic problems of immigrant doctors; the design of teaching - learning systems and objectives of a one-year postgraduate biology teachers course.

Some recent publications (1971) by Unit Staff include:-

"Teaching Students in Groups" - Bligh, D A
(A collection of nine short papers, available from the Unit.)

"What's the use of lectures?" - Bligh, D A
(Available from the Unit)

"The content and purposes of biochemistry examinations" - Beard, R M and Pole, K E
(British Journal of Medical Education, 5.1.13-21).

12. "Self-Teaching Systems in University Science Courses"

This is a short progress report on the Leverhulme Research Project 1970/71 and is issued by the Institute for Educational Technology, the University of Surrey.

During the first year of this project, 1969/70, the pattern of the work was to investigate a number of methods and techniques in terms of their effectiveness for the development of individual learning situations and as possible components if a systematic approach to the educational content of university science courses. These experiments also investigated staff and student attitudes to innovation methods and media. This work is detailed in the first progress report of the project which became available in May 1970. The project has now completed its second year and during this time has been concerned with the application of the knowledge gained during the first year to a systematic approach to university science courses and to pilot experiments designed to investigate some of the fundamental bases of self-teaching situations.

A system has been designed which integrates self-tests with lectures, tutorials, tape-recordings, tape/slide presentations, programmed books and other reference material in an attempt to provide individual learning paths for students on a particular course. This system is intended as a first step towards bridging the gap from the stricter discipline of the school situation to the more flexible environment of the university. The system attempts to promote good study methods and to make the student aware of and confident in the use of various source materials. The intention is that such a system could be used for first-year undergraduates but that once good study habits and a degree of self-reliance have been established the system could be faded out, thereby leaving the student in a position to obtain maximum benefit from the final years of his degree course.

Some of the main points which seem to be emerging from the work of this project are:

12.1 The traditional university system of lecture, tutorial and practical work is designed primarily in terms of its teaching function and not in terms of the consideration of the needs of the learner.

12.2 What at the present time are generally considered to be audio-visual aids mainly to support conventional lecture material can also be used effectively in a student self-teaching situation.

12.3 The use of self-teaching situations has led to a consideration of the library as a resources centre not just for books but for tape-recordings, tape/slide presentations, loop films etc. In the work of the project there has been considerable support in terms of space allocations and use of library staff for the cataloguing and issue of material by university librarians. It is obvious that the library of the future will not be just a book collection but will handle many other audiovisual materials designed for use in self-teaching situations.

The report booklet has two appendices: Appendix A lists the main experiments carried out during the two terms Autumn 1970 and Spring 1971. Appendix B lists the staff concerned with the project, their publications, papers presented at conferences; lectures, seminars given by them and exhibitions concerned with educational technology.

13. Concurrent studies in Science and Education (see SEN 15:11)

The Centre for Science Education at Chelsea College, London University, is to begin a new BSc Honours Degree in 1972. The course will combine studies in Education with a main science subject of mathematics. It will lead to a BSc Honours Degree after three years or to a BSc Honours Degree with a graduate Certificate in Education after four years. Although the

course is primarily intended for students who wish to teach or are thinking about teaching science or mathematics in schools, it is also planned to meet the requirements of students who may wish to teach in further education. For those who do not intend to take up teaching as a career, the course meets the needs of students whose main interest is in science or mathematics but who would like to consider the educational implications of their main interest. The course is also open to students who would like to combine interest in social science with science or mathematics. The degree is based on the London University course unit system which gives students a considerable degree of flexibility to opt for subjects which suit their particular interests. In the first year students can take 3 or $3\frac{1}{2}$ units in science or mathematics and one half or no units in education. In the second and final years of the course students take a minimum of 4 units in science and mathematics and a minimum of $2\frac{1}{2}$ units in education. Course units in education include introduction to educational psychology, history and administration of education, the child, school and society, communication and curriculum studies, sociology of science (mathematics) education, the teaching of science and mathematics and bio-social aspects of education. An extremely important feature of the course is that after the second year and before the final year, students have the choices of either proceeding to the BSc degree in the Faculty of Science or to a BSc degree and a graduate Certificate in Science Education. If students decide to opt for the graduate Certificate in Science Education they will spend one year before their final year gaining practical teaching experience in a variety of different schools and acquiring a working knowledge of social services connected with education. During the year students will be under the supervision of co-tutors in the schools in addition to tutors from the Centre. In their final fourth year they will be expected to submit a dissertation.

Entry qualifications for the course are at least 2 passes in GCE at Advanced level, one in a science subject which is appropriate to their field of study, and the other in chemistry for those taking the biological sciences or mathematics for the physical sciences.

14. School/University Physics Interface Project (See SEN 15:12)

The main developments in this project have been in the field of pre-course diagnostic testing, ie finding significant gaps in knowledge or understanding of an area or topic in physics before a course of instruction begins. It is hoped eventually to be able to remedy any deficiencies or weaknesses by employing self-teaching techniques as well as by face to face discussion with tutors. No trial material is yet available but a final report is due to be published at the end of the year. Further information can be obtained from the co-ordinator of the project, Mr R A Sutton, Co-ordinator, Physics Interface Project, University College, PO Box 78, Cardiff CF1 1XL.

15. Schools Council Project: The Formation of Scientific Concepts

Following the exploration of new approaches to the teaching of science and mathematics and the work of such projects as Nuffield Junior Maths, Nuffield Junior Science, Science 5-13 and Environmental Studies 5-13 the research project was established to

15.1 Construct and carry out tests that enable the research team to study the development of scientific and mathematical concepts in children between the ages of 7 and 12 and

15.2 Attempt to relate this development to

15.2.1 Maturation of the pupil

15.2.2 Ability (IQ) of the pupil

15.2.3 Social background - home and school environment.

It was intended that these tests should be available for use by teachers as measures of development. The project was established in 1968 at the University College of North Wales, Bangor. Director of the project is Dr J Rogers, Coordinator Mr E Rothwell-Hughes. The research team has been working in close association with groups of teachers in Wales and has tested the resulting material with a carefully selected sample of children. Their programme has included

15.3 The construction of concrete test material that can be readily handled by children.

15.4 The grading of different test items in a sequence that provides a measure of concepts development.

15.5 The construction of a standard form of questioning procedure.

15.6 The construction of recording sheets which will enable project members and eventually teachers to analyse the response of the children.

To date the project has not published any material although Mr Hughes gave an address to the British Association at its meeting in Swansea in September 1971 and copies of this paper are available. The paper gives a statement of the aims of the project, description of test material, an interim report on some of the research findings. The team is currently preparing a research report for submission to the Schools Council in addition to the test material outlined above. Further information can be obtained from the Director of the project, Dr J Rogers at the University College of North Wales, Bangor.

16. The Science Teacher Education Project (STEP) Information Bulletin No 4 (See SEN 13:7 and 15:4)

16.1 Topic areas The curriculum units are being collected or devised and developed by 12 groups of tutors. Each group is taking responsibility for one of the topic areas into which the overall content was divided. These are:

Aims and objectives

Conceptual thinking in science

Methods and techniques

Resources for learning

Laboratory design and management

Safety

Teacher/pupil interaction

Understanding and communication

Age and ability

Curriculum design

Assessment and feedback

The social context of science teaching

16.2 Proposed publications The following books are planned for publication McGraw-Hill in late 1973:

16.2.1 Innovation in Higher Education: The Science Teacher Education Project This is a descriptive booklet about the project containing a discussion of objectives, methods, content, student motivation assessment and evaluation.

16.2.2 Experiences for Science Teachers This will contain the collected curriculum units with evaluation details.

16.2.3 The Art of the Science Teacher A discursive handbook for teachers and student teachers with one chapter on each of the topic areas.

16.2.4 Film Review A review of films of potential value in the education of science teachers. The publication of this book is being sponsored by ICI Ltd.

16.2.5 Readings in Science Education A collection of information and provocative writings of interest to science teachers.

16.2.6 Case Studies in Science Education A wide ranging selection of case studies and simulation exercises for individual use or as a basis of group discussion.

16.2.7 Pupils' Writings in Science Designed to put the reader in the shoes of the pupil and to give an insight into what pupils are really like.

16.2.8 Activities in School for Student Science Teachers Observation exercises and assignments of various types aimed at helping the student teacher to make the most of his experience in school.

16.3 STEP Units on trial A catalogue of all the units on trial in the academic year 1971-72 "Trial of curriculum units catalogue", is available from the Project office at the School of Education, University of Reading, price £0.25. Cheques etc should be made payable to the University of Reading.

17. Project PHI (Programmed Materials for Highlands and Islands), Department of Education, University of Glasgow

Project PHI is a research and development project which through the production of programmed multi-media packages for parts of the first two years of the Scottish secondary science course hopes to investigate how far such packaged programmed materials can help to reinforce the work of teachers, particularly teachers in the smaller secondary schools in the Highlands and Islands of Scotland. The Project is not primarily concerned with the production of curriculum material, nor is it attempting curriculum revision, it could be said that its main function is to investigate means for facilitating the implementation of Curriculum Paper 7. This document sets out the policy of the Scottish Education Department with the respect to the teaching of a common course in elementary science for the first two years of the secondary school.

The Project is directed by Mr Martyn Roebuck and there are secretarial staff, Graphic Artists and a full time Research Assistant who is concerned with the production of the teaching materials. These materials are intended to be making use of the normal facilities available in schools and the expectations of

the teachers in their use of audio visual materials and equipment. It is hoped not to introduce new pieces of equipment or particularly different techniques of teaching rather to try to fit programmed approaches into the conventional expectations of teachers. At present the first package (which is concerned with current electricity) uses filmstrip, tape and workbook, programmed worksheets linked to practical work, and a game-like group activity.

Since the work of this Project stems from ideas developed in earlier work in assessing the usefulness of programmed materials in developing countries, it is hoped that materials that are actually produced under this Project and the methods will be useful for teachers of science in remote areas outside the Highlands and Islands of Scotland, in particular in those parts of the world which are now using the Scottish Integrated Science Course and other similar courses but which suffer from a shortage of equipment and suitably qualified teachers.

Project PHI is sponsored by the Scottish Education Department. Any enquiries should be directed to Mr Martyn Roebuck, Project PHI, Department of Education, University of Glasgow, G12 8QQ, Scotland.

ACTIVITIES IN BRITAIN - MATHEMATICS

18. School Mathematics Project (See SEN 12:10)

18.1 New Developments The School Mathematics Project is now 10 years old and during these 10 years the project, which is a major one in secondary school modern mathematics, has produced GCE O and A-level syllabuses which have been published and are now widely used. The project is now giving serious thought to its activites for the next 10 years. One of the most important and interesting fields for mathematical education concerns the middle years, that is 8/9 to 12/13 years of age. Quite apart from the challenge of new syllabus content teachers of this age range have also had to cope with such factors as the new middle schools, comprehensive secondary schools, the spread of mixed ability teaching and developments in educational technology. The School Mathematics Project feels that the time has come for an all-embracing review of the mathematical problems of the middle school of the 1970's and 1980's with a view to producing in due course a range of materials and a service to teachers which might hold good for a number of years. The project is arranging a working conference at the end of April 1972 and the aim of the conference will be to produce a report from which will emerge guidelines for 5 to 10 years work for the School Mathematics Project. In particular, it will make suggestions for the organisation of the work (including the teams of teachers which will produce the materials), books, methods of communication, training methods, assessment and so on. Members of the conference will be split into about 10 groups under appointed leaders of wide experience and each group will be given the task of writing a chapter of the final report. The topics for groups are:

Objectives of mathematical education in the middle school

Foundations for the middle years course

Curriculum for middle years

Applications, problems and projects

Training and deployment of staff

Class organisation

Assessment and record keeping

Communication, teacher with child, child with teacher

Rooms, furniture, facilities

Further information on the results of the conference and copies of the report will be available from Dr Bryan Thwaites, Director of SMP, Westfield College, Kidderpore Avenue, Hampstead, London NW3 7ST.

Apart from the above new developments at SMP there has been continuing activity on the materials that have previously been published.

18.2 The main school course: SMP Books A-H for CSE level Sets of transparencies for overhead projectors for use with each of books A-H are now being tested in schools. The sets linked with books A-D are published and the transparencies for book E and book F will be available in April 1972. The books of transparencies are designed for use with a Flipatran viewer on an overhead projector. Enquiries about the viewer should be addressed to Transar Ltd, Visual Education Division, East Hadley Lane, Godmanchester, Huntingdon.

Drafts of workcards for use as supplementary material with books A and B are being tested in a number of schools; details are available from the SMP Office. Preliminary drafts of cards for use with books C and D are now being prepared.

The main school course is emerging as a sound basic course for all pupils in many schools and there is a need for an extension of the series to cater for O-level pupils. Three new texts will lead from book G to GCE O-level or its equivalent.

Book X, to be published in January 1973,
- 'Thinking in 3-D'
- sets
- rates of change
- function
- transformation
- formulas
- statistics
- orderings
- matrices
- computation
- vectors
- area

Book Y, available mid-1973,
- co-ordinates
- rates of change
- sets of numbers
- linear programming
- tangents
- slide rule and application
- base-vectors
- plans and elevations
- simultaneous equations
- mensuration
- transformations
- gross function

Book Z, available early 1974,
- vectors
- kinematics
- functions
- combination tables
- latitude and longitude
- review chapters on matrices, geometry, statistics and probability
- graphs
- algebra
- computation

18.3 The VIth Form Courses Revision of the A-level course is now being undertaken and further information on this can be obtained from the SMP Office.

18.4 SMP Computing in Mathematics A team of authors is now engaged in preparing a new set of experimental texts and handbooks. They will examine various topics in school mathematics and their treatment in the light of the development of the computer. The SMP Computing Series aims to provide schools with material which will help them devise courses which

will be appropriate to their pupils.

Book 1, 'Some Experimental Ideas for Teachers: This first book in the series lays down some guidelines which teachers will want to consider. Elementary principles are dealt with and teachers are shown how to introduce their pupils to computing and warned of the pitfalls which they may come across. There are plenty of examples in the texts and problems are included at the end of each chapter. The authors write with a good deal of experience of computing in schools and they are well qualified to explain how the powerful ideas behind the techniques of modern computing are best taught in schools. Available in March.

Book 2, 'From Problem to Programme, an introduction to Programming at a simple level: Using this book either as a source book or as a text the teacher, however inexperienced, will be able to construct a computer course using whatever facilities are available suitable for the needs of the average secondary school pupil in the 12-16 age range. The steps involved in going from a problem to a flow-chart and then writing a programme are clearly explained with many exercises. In particular jump instructions are discussed in detail. Available in May.

Further titles in preparation - 'Data Processing', 'Linear Equations', 'Sequences and Series'.

18.5 SMP Outside the United Kingdom SMP texts are being translated into Italian, Spanish, Turkish and Japanese. Adaptations are now on sale in East Africa, the USA and Hong Kong. Work is going ahead on adaptations for West Africa and Botswana, Lesotho and Swaziland and there are similar plans for Malawi and Canada. Further information about published adaptations and inspection copies are available from the following:

USA	The Cuisenaire Company of America, 12 Church Street, New Rochelle, NY 10805
East Africa	East African Publishing House, PO Box 30571, Uniafrica House, Koinange Street, Nairobi, Kenya
Hong Kong	United Publishers Services, 7th Floor, Stanhope House, 734 King's Road, Hong Kong

All the other published texts are available throughout the world through Cambridge University Press offices, representatives and agents.

Further information on any of the SMP work can be obtained from the SMP Office at Westfield College, Kidderpore Avenue, Hampstead, London NW3 7SP.

19. Scottish Mathematics Group - a reappraisal

19.1 The work of the Scottish Mathematics Group has received widespread attention in the United Kingdom and in other parts of the world. The original series of books appeared in 1965 but since 1965 there has been a widespread move towards more comprehensive education and in the UK this has meant that greater opportunities are being given to pupils in a wider range of ability to have access to a certificate oriented course than was previously the case. For this and other reasons the material, particularly of the early books in the series, has now been recast so that it will be suitable for the majority of secondary school pupils while at the same time offering a challenge to the most able pupils. A thorough re-editing and

revision of the books has in fact been carried out. Throughout the writing of the revised books an attempt has been made to keep in mind recent changes in primary school methods and attainments. In the early books in particular the pace is reasonably leisurely; an appropriate element of practical and discovery work is included. Equally, note has been taken of changes in university and college courses in mathematics. Thus the whole structure of a boy or girl's mathematical career is surveyed and studied in an effort to provide a suitable component at the secondary school stage and the content of the revised course is appropriate to an increasing number of mathematical syllabuses, including the University of London mathematics syllabus C; the Associated Examining Board mathematics syllabus C etc.

19.2 The major changes include the following:

19.2.1 A streamlining of the overall content of the series.

19.2.2 A rearrangement in the earlier books of the series in order to slow down the pace to increase the practical work and to incorporate sets of parallel exercises.

19.2.3 A re-writing of many sections of exercises in order to improve the methods given, the presentation of the text and the type of example. The overall content and development has been retained but the geometry in particular has been pruned considerably in an effort to cut the textual material and to emphasise various mathematical milestones reached.

19.2.4 Currency in all the books is in decimal form - £ = 100 pence. Metric units of weights and measures are used exclusively based on the SI units which are now being adopted widely throughout the world.

19.3 In order to explain the changes in greater detail the publishers have produced a Modern Mathematics Newsletter No 1 in which the main features of the revised courses of Modern Mathematics for Schools are fully described. It also provides an outline of the aims, philosophy and methods which should be of interest to readers who are using the books both for the first time and those who are familiar with the present series. The overall aim of the authors and publishers has been to provide a functional and fully integrated package of mathematical material for teachers and pupils which comprises

19.3.1 the newsletter

19.3.2 the revised course Modern Mathematics for Schools, Books 1-9

19.3.3 the teachers' editions of the pupils' books

19.3.4 progress papers of objective tests related to each pupils' book

19.3.5 activity workbooks 1 and 2

19.3.6 the graph workbook for Modern Mathematics

19.3.7 3-figure mathematical tables for Modern Mathematics

19.3.8 certain associated books for specific purposes, including Modern Arithmetic for Schools and Book 5A for CSE candidates

19.3.9 the sixth year books which are at present in preparation.

That segment of the ability range not covered by this course is catered for in a set of cards which will be published within the year. Compiled by the Scottish Maths Cards Committee and published by Blackie & Chambers, these cards are provisionally entitled 'Do, Discuss, Discover Maths'.

Further information on these developments and copies of the newsletter referred to above may be obtained from either of the publishers, Messrs Blackie, Bishopbriggs, Glasgow, and Messrs Chambers, 11 Thistle Street, Edinburgh EH2 1DG.

20. Mathematics for the Majority Project (See SEN 17:9)

A new teachers' guide has been produced - a trial draft version not for public use. It is entitled "Crossing Subject Boundaries" and shows how mathematics links up with other subjects. The subjects considered, one per chapter, are geography, orienteering, history, environmental studies, science handicrafts, art, music, sport and hobbies.

The aim of the book is to examine ways in which the maths teacher might work together with teachers of other subjects. This is done partly because it is believed that cooperation amongst teachers is worthwhile in itself and partly because it is felt to be better for pupils to see some of the wider uses of maths instead of just "maths for maths sake".

Also, it is hoped that teachers whose interests and expertise lie in fields other than maths, but who are required to teach maths for part of the time, will gain encouragement from the book and will see various ways in which their own specialist knowledge can be an asset in the maths lesson and not an encumbrance.

The following sections are included in the chapter on geography: distance, graphical representation (blockgraph, line graph, scatter-graph, pie diagram), contours and transects, flow diagrams and punched cards, networks and matrices, shortest paths and one-way systems, central place study and geographical games.

ACTIVITIES IN BRITAIN - GENERAL

21. The James Report on Teacher Education and Training, published by Her Majesty's Stationery Office, price 85p

The long-awaited report of the James Committee was published by HMSO for the Department of Education & Science in late January 1972. The terms of reference of this Committee were as follows: "In the light of the review currently being undertaken by the area training organisations and of the evidence published by the Select Committee on Education & Science, to enquire into the present arrangements for the education, training and probation of teachers in England and Wales and in particular to examine:

21.1 What should be the content and organisation of courses to be provided.

21.2 Whether a larger proportion of intending teachers should be educated with students who have not chosen their careers or chosen other careers.

21.3 What, in the context of 1 and 2 above should be the role of the maintained and voluntary colleges of education, the polytechnics and other further educational institutions maintained by local education authorities and the universities,

and to make recommendations."

The report recommends that the education and training of teachers should be seen as falling into three consecutive stages or cycles, the first - personal education; the second - pre-service training and induction, and the third - in-service education and training. It recommends that the highest priority should be given to the expansion of the third cycle, ie of opportunities for the continued education and training of teachers. It also recommends that the pre-service higher education and training of all teachers for the schools should extend over at least 4 years. The report envisages that a new 2 year qualification, the Diploma of Higher Education (DipHE) be set up as the initial cycle of general education for many teachers. The initial training of teachers in the second cycle, which is the professional component of the training programme, is to last at least two years, one in a professional institution and one in a school. It is noteworthy that it is proposed that this should be the same length for all intending teachers however much it might vary in content and style, and should lead to the same terminal award, a new terminal degree of BA Education. Successful completion of the first year of the second cycle should lead to recognition as a licensed teacher; successful completion of the second year to recognition as a registered teacher and award of the BA(Ed). In addition to changes in the structure of education of the teachers, the administration and planning of the system of teacher education and training is also given attention and it is suggested that it should be entrusted to Regional Councils for Colleges and Departments of Education (RCCDE) which, beside representing professional teacher training institutions and local education authorities, should also involve all universities and polytechnics within their boundaries together with some other membership. In addition it proposes that there should be a National Council for Teacher Education and Training (NCTET) linked with the RCCDEs and thus strongly representative of all branches of the teaching profession.

The concentration on in-service training in the third cycle - the continued education and training of teachers - seems to have been generally welcomed throughout the teaching profession. The report itself recommends that all teachers in schools and fulltime staff in further education colleges

should be entitled to release with pay for in-service education and training on a scale equivalent to not less than one school term, say 12 weeks, in every 7 years of service and as soon as possible the entitlement should be increased to one term in 5 years and the entitlement should be written into the teacher's contract of service. It further recommends that the entitlement should be satisfied only by release for substantial courses lasting at least 4 weeks full-time, or their approved part-time equivalents, and such courses should be those designated for the purpose by the RCCDEs. The entitlement should also be in addition to shorter term third cycle activities whether or not involving release from teaching and these short term opportunities should themselves be substantially expanded.

The report then goes on to pay considerable attention to the means of fulfilling its recommendations for in-service education expansion and in particular recommends that staff of schools and colleges should be designated professional tutors to coordinate second and third cycle work affecting the institution and to be the link with the other agencies concerned. These teachers should be the first to be released for third cycle courses. Also, to accommodate third cycle work, there should be a national network of professional centres which would include not only the colleges and departments of education but also a number of other centres based on existing facilities and in some cases the development of teachers' centres.

In the research and development field, the report recommends that teachers in schools and colleges should have full opportunity to take part in curriculum development projects and other projects and investigations. It also considers it necessary that teaching staff in colleges and departments of education should be enabled to undertake suitable projects of fundamental research.

On the subject of formal qualifications at a higher level, the report recommends that the BEd degree should be extensively developed as an in-service award based on a one-year fulltime course or its part-time equivalent. It also suggests that selected colleges and departments of education should offer one-year courses leading to a new in-service award of MA(Education) open to holders of the BA(Ed) immediately after completion of the second cycle or after an interval of further teaching experience. It emphasises that there should be adequate opportunities in the third cycle to take higher degrees in education including research degrees.

An interesting point is raised under the subject of qualifications for entry to the second cycle. It is envisaged that suitable qualifications would include those holding acceptable awards from the first cycle, holders of university and CNAA degrees, certain specialist qualifications, the diploma of higher education and certain other diplomas would all be considered formally eligible for admission to the second cycle. It goes on to say that it considers that holders of degrees and specialist qualifications should not be given automatic preference over other applicants whose more broadly based education made them more suitable for certain kinds of teaching. It emphasises that in selecting candidates for the second cycle, great weight should be given to their personal qualities, motivation and experience as well as to their formal qualifications.

The process of raising the entry requirements for teacher education which has gone on for some time in the United Kingdom is further strengthened by the suggestion that the normal requirement for entry to the first cycle for diploma of higher education courses should be the possession of 2 A-levels in the General Certificate of Education, although it is accepted that there should be generous provision for exceptions in the case of mature entrants and those applicants who, although possessing different formal qualifications are strongly motivated to teaching and give promise of becoming effective teachers.

The report has already aroused considerable discussion on its somewhat revolutionary proposals and full consultations will now take place between the Department of Education & Science and the various bodies concerned with a view to ascertaining their opinions and it will be some time before a final decision is reached on the implementation or otherwise of some or all of the recommendations contained in the report. Whatever the ultimate outcome of this further consultation, there is no doubt that the report has stimulated a most constructive analysis of the teacher education situation in relation to United Kingdom needs which will have far-reaching implications for such work in the future.

22. Curriculum Diffusion Research Project (supported by the Social Sciences Research Council (SSRC))

The project team is collecting references on studies of change in education to share with interested teachers and research workers. Of particular interest are quantitative and case studies focussed on materials developed by a national curriculum project and/or related changes such as schools organisation, examinations and pupil background. A list of other topics of interest is provided below and references for inclusion in a future bibliography are welcomed.

Studies of:

22.1 influences on the initiation of a curriculum development project;

22.2 the history of development and trials of materials;

22.3 the dissemination of information on the project;

22.4 communication of information to and between teachers;

22.5 the adoption process in individuals and groups;

22.6 the diffusion of project materials to teachers and schools;

22.7 the implementation of project materials - content and techniques;

22.8 the new materials compared to former practices, ie extent of "innovation";

22.9 the sources of resistance;

22.10 the effects of the new materials on teachers, schools and pupils;

22.11 the influences of society on the initiation of a project and subsequent adoption of new materials;

22.12 experimental designs and models of analysis;

22.13 comparative educational change between different countries;

22.14 comparative change between disciplines.

A booklet has been produced entitled "Annotated Bibliography on Change in Education in England and America with an Emphasis on Science Education".

The purposes for producing this Bibliography are:

22.15 to introduce the teacher who wishes to do research in some aspect of change in science education to the relevant literature;

22.16 to provide a basis of sharing recent references of studies on change in education with interested research workers.

The sources have been put under the following headings:

Models of analyses

Methodology of statistics

Comparative studies

General and recent references

General references for education in England

Studies of change in education - multiple innovations

Studies of change in science education

Studies of change in special programmes in education

Studies of change in social sciences education

Studies of change in humanities education

Further information from Robert B Nicodemus, Centre for Science Education, Chelsea College, University of London, Bridges Place, London SW6, England.

23. Project Environment (See SEN 18:1 and 18:3)

In 1965 the Schools Council set up, after consultation with the National Rural Studies Association, a Working Party to enquire into the nature of rural studies in secondary schools and by an analysis of the information thus obtained:

23.1 To clarify the meaning of the term 'rural studies' as applied to school courses and to identify the place of rural studies in the curriculum of the secondary school in relation to the age and ability of the pupils likely to profit from the subject.

23.2 To determine the objectives of rural studies and the means by which these objectives are generally achieved.

As a result of this enquiry, the findings of which were published in Rural Studies in Secondary Schools, Schools Council Working Paper 24, a research and development project was established whose aims were:

23.3 To define the nature of the subject: for example, what areas of knowledge are involved? What is the philosophy of the subject? What are the education objectives and by what methods are these to be approached?

23.4 To examine more closely the part which the subject might play in educating children to the environment and encouraging an enlightened interest in the quality of the environment and concern for its intelligent management.

23.5 To enquire into the subject's relationship with other subject areas.

23.6 To investigate ways in which satisfactory courses in the subject for all children might be provided.

23.7 To examine the facilities necessary for children to gain satisfactory practical experience in the subject in middle and secondary schools.

The project has produced two progress reports, one in January 1971 and a second one in January 1972. The first report gave information about the project under the headings:

23.8 About Project for Environment;

23.9 The role of rural studies;

23.10 The first phase;

23.11 What needs to be done;

23.12 The priorities and

23.13 How shall we proceed with our priorities?

In the second report the project felt it would be useful to look at the new interest in environmental matters and the call for more environmental education from a broader viewpoint. The report therefore includes a selection of statements made on behalf of various bodies concerned with the environment. These have been arranged in six broad categories:

23.14 International concern about man's use of his environment.

23.15 Concern in Britain about man's use of his environment.

23.16 International steps towards environmental education.

23.17 Environmental education in other countries.

23.18 Environmental education in Britain.

23.19 Steps being taken to satisfy the demand for environmental education.

These reports are available from Project Environment, Department of Education, The University, Newcastle-upon-Tyne NE1 7RU. The duration of the project is from 1970 to 1973, age range 8-18 years. By the end of the project it is hoped to have developed materials with teachers not simply for them: this may mean asking teachers who are doing interesting work to develop it further as well as inviting teachers to develop in their own particular way ideas initiated by the project. The outcome of such work may be the publication of a series of case studies or the formulation of ideas which need more widespread testing through trial schools. Some 30 or so pilot schools will test material working closely with the central team and it is hoped that there will also be a number of associate schools linked with the pilot schools.

The Director of the project is Mr R W Colton, Department of Education, The University, St Thomas' Street, Newcastle-upon-Tyne NE1 7RU.

24 The relevance of school learning experience to performance in industry

A grant of £45,000 has been made jointly by the Engineering Industry Training Board and the Leverhulme Trust to sponsor a 4 year research project (1971-75) to investigate the relevance of school learning experience to performance and attitudes of young trainees who enter employment directly from school. The project offers a relatively rare opportunity for practical cooperation between education and industry. The investigation will be conducted by Dr Erica Glynn and will be based at the Centre for Science Education, Chelsea College, University of London, which is closely associated with curriculum development and other innovations in schools and universities.

A problem which concerns educationists, industrialists and above all young people entering employment is the extent to which innovations in education and changes in industry reinforce or work against each other. It is very important not to interpret this in terms of possible vocational courses in schools, but rather as relating the interaction between school training and further education. One of the effects of raising the school leaving age is to high-light problems of this kind. The following questions indicate important aspects of the problem:

24.1 What is the relevance to the subsequent work in industry of attitudes and abilities developed by innovative methods in schools; which aspects of their school education are likely to be of greatest value to young trainees?

24.2 What are the best methods of training young people who have had experience of innovative school courses; how may their skills be best used?

24.3 What problems arise if there are major differences between instructional methods used in schools and further education in industry?

25. Standing Conference on Schools, Science and Technology (SCSST)

Initiatives in the field of science and technology are not new and recent years have seen many interesting and useful developments, Nuffield Science, Schools Council Project Technology, Science and Technology Centre, the CIA Link Scheme, the Shell Project at the University of Surrey and others have all played their parts in seeking to ensure that science and technology teaching have been relevant to the needs of the industrial society in which we live. Most of these initiatives have had the ready co-operation of schools, higher education in industry and many have been local in concept, financing and operation. This is particularly true of the Teachers' Centres. It is now generally felt that a national platform or forum is needed to assist existing ventures, promote new ones and provide a national information service covering the whole field to ensure that experience gained in one area may benefit another. Such an organisation, the Standing Conference on Schools, Science and Technology (SCSST) came into being in January last with His Royal Highness the Duke of Edinburgh as its first President and Vice-Admiral Sir Frank Mason KCB as Chairman.

In 1968, following a Conference of the Association for Science Education, of which Prince Philip is Patron, an action group was set up consisting of industrialists, educationalists and others with Prince Philip as Chairman to investigate how the cause of science and technology teaching in schools could best be served in future to make sure that an adequate number of talented boys and girls took up careers in technology. The action group, which became the Schools Science and Technology Committee, was concerned to help teachers in schools make the teaching of science more meaningful to its application, make clear its relevance to every-day things one sees, reads about or handles and to show what an important contribution it could make to the quality of human existence in the hands of imaginative and creative people. A report was produced which identified a need for the organised promotion of local links between schools, other branches of the education service and industry. It suggested that a national framework for local support of school science and technology could promote cooperation between local organisations to enable individuals to identify their roles in coherent major educational development and help to realise the educational potential of national institutions and associations. In addition, the publication of a regular bulletin by such a national body was seen as essential for the dissemination of successful ideas and also to help avoid wasteful overlaps by different organisations. In January 1971 the inaugural meeting of the Standing Conference on Schools, Science and Technology was held at the Institution of Mechanical Engineers in London.

The Standing Conference may be said to be a fully representative organisation having at present 54 member organisations divided into 5 groups.

Group 1 - Teachers' Subject Associations;

Group 2 - Teachers Professional Associations;

Group 3 - Local Authority organisations;

Group 4 - Professional Institutions and related bodies;

Group 5 - Industry and industry-sponsored organisations, including the CBI.

In addition there are assessors from the Department of Education and Science, the Department of Trade & Industry and the Scottish Education Department. The aims of the Standing Conference are to:

25.1 Encourage local co-operation between schools, further and higher education in industry, especially between local branches and individual members of organisations represented on the Standing Conference.

25.2 Support the work of all centres to encourage co-operation between Management Committees and officers where centres for a number of different disciplines exist in the same area.

25.3 Encourage and support the setting up of new centres.

25.4 Offer advice based on knowledge of what has proved successful in other areas to individuals and organisations wishing to initiate, extend or support relevant local activities.

25.5 Promote the sharing of local experience and ideas on a nation-wide basis.

A National Liaison Officer, Mr K C H Bootheway, has recently been appointed to direct the Conference's activities.

It is hoped that industry, which stands to gain considerably from the higher quality technical manpower which must result from any activities which the Conference supports and hopes to promote, will follow a lead given already by the British Petroleum Company and by the Institution of Mechanical Engineers and support the Conference over and above any support it at present gives to local science and technology centres and related activities. For the future there is of course the broader aim of making education for all children relevant to the industrial society in which we live. This is just as important for potential accountants, psychologists, social workers, teachers, economists, clergymen or even a housewife as it is for the potential engineer or scientist. For this reason organisations such as the Historical Association, the Economics Association, the National Association for Art Education and the Geographical Association have been included in the membership of the Standing Conference.

A newsletter describing the work of the Standing Conference on Schools Science and Technology has been produced by the Institution of Mechanical Engineers, 1 Birdcage Walk, London SW1H 9JJ. This first edition contains more details of the Standing Conference, information from the regions on the activites of the various science teachers' and technology centres throughout Britain and includes a note on the setting up of the School Technology Forum which, working to, for and through the SCSST, will give teachers of all disciplines the opportunity to follow a number of aims:

25.6 To receive trends, to identify needs, to generate ideas and to initiate developments in school technology and to make suggestions regarding the training of teachers.

25.7 To interpret suggestions related to the teaching of technology in schools brought forward by members of the SCSST.

25.8 To help convene such working parties of practising teachers as the SCSST may from time to time require.

25.9 To provide lines of communication on technological matters among teachers and in particular to foster the publication of Schools Technology.

A list of the member organisations of the Standing Conference on Schools, Science and Technology is also appended to this newsletter.

26. National Foundation for Educational Research (See SEN 17:15)

The National Foundation for Educational Research announced in January the appointment of a new Director. He is Mr Alfred Yates, MA, MEd, FVTsS who is at present senior tutor and lecturer at Oxford University Department of Educational Studies. He takes over the post of Director from the late Dr Stephen Wiseman who died in July last year. Mr Yates was senior research officer in charge of the research programme of the Foundation between 1951 and 1959. He will take up his appointment in April 1972.

27. English Language Book Society (ELBS)

This is a society of leading British publishers who have combined to carry out Britain's low-priced books scheme which has now been in operation effectively for more than ten years.

The chief object of this scheme is to enable students at universities, colleges of technology, and other readers in developing countries included in the scheme, to buy essential textbooks at between one half and one third of the cost of the standard editions. The books are identical to those originally published and sold through usual Book Trade channels.

There are over 400 different titles available covering a wide range of subjects.

A catalogue giving all titles and special catalogues on English Language, Economics, Engineering, Medicine and Nursing may be obtained free from The ELBS, PO Box 4BR, London W1 or from your local British Council Representative.

The ELBS are always pleased to receive suggestions for further titles to be added to the list.

ELBS low-priced textbooks are, at present, available to the following countries:-

AFRICA: Burundi, Federal Republic of Cameroon, Central African Republic, Republic of Chad, Congo Republic, Democratic Republic of the Congo, Republic of Dahomey, Ethiopia, French Territory of the Afars and Issas, Republic of Gabon, Gambia, Ghana, Guinea, Republic of Ivory Coast, Kenya, Liberia, Malagasy Republic, Malawi, Republic of Mali, Republic of Mauritania, Mauritius, Republic of Niger, Nigeria, Republic of Rwanda,

Republic of Senegal, Republic of Sierra Leone, Somali Republic, Tanzania, Togo Republic, Uganda, Republic of Upper Volta, Zambia.

ASIA: Afghanistan, Brunei, Burma, Ceylon, Hong Kong, India, Indonesia, Malaysia, Nepal, Pakistan, Singapore, Thailand, Vietnam.

28. PUBLICATIONS

28.1 Schools Council Examinations Bulletin 23
A common system of examining at 16+

Published by Evans/Methuen Educational, price 35p. (61 pp).

A Working Party was set up with terms of reference as follows:-

to adumbrate possible ways of implementing the decision for a common examination system at 16+ and to indicate the implications which flow from them.

The issues raised in the report on which a firm view is expressed or specific courses recommended can be identified as follows:

28.1.1 the common system of examining at 16+ should:

put the curriculum first;

be designed to assess attainment;

provide for a variety of modes of examining, methods of assessment and moderating procedures;

be largely in the hands of teachers and therefore be controlled by teachers.

28.1.2 the percentile range 40-100 should be adopted initially as the range of ability to be covered;

28.1.3 the pass/fail concept should find no place in the new system but there should be an unclassified category;

28.1.4 winter examinations should be available;

28.1.5 the simultaneous introduction of a profile method of reporting results which finds support in some quarters, could be damaging to the establishment of confidence in the new system and is not recommended.

28.1.6 the conditions of entry should contain neither an upper nor a lower age limit.

The following issues are those on which it is considered that definite advice must await the outcome of further studies:

28.1.7 the technical problem of examining over a wide range of ability;

28.1.8 the optimum number of grades, which is thought likely to be not less than five and not more than nine, but which requires further study;

28.1.9 the need for the immediate establishment of a special body to examine and advise on the problems of the management structure of the common system including regionalism;

28.1.10 the need for wide consultation and subsequent action with regard to the incorporation of familiarization in examining and assessment techniques into programmes of initial and in-service training of teachers;

28.1.11 specific problems relating to Mode III.

28.2 New UNESCO Sourcebook for Science Teaching

The new UNESCO Sourcebook for Science Teaching has been prepared with the intention of bringing the UNESCO Sourcebook for Science Teaching up-to-date and of providing a broader coverage of scientific material likely to be included in introductory science courses. Provision for the new addition was made by the general Conference of UNESCO at its 15th session in 1968 following a request by member states. The revision was co-ordinated at the Science Teaching Centre of the University of Maryland, USA, under the general editorship of Dr J David Lockard, Director of the Science Teaching Centre and its international clearing house on science and mathematics curricula developments. Additional members of the revision team were Alfred de Vito, J Dudley Herron, Ralph W Lefler, Robert W Menefee and Wayne Taylor. In preparation for the revision large-scale comment and feedback from the users of the previous edition of the UNESCO Sourcebook for Science Teaching was collected by the World Confederation of Organisations of the Teaching Profession; teachers' organisations and professional associations were invited to contribute suggestions for improvement and a special study was conducted by the Zambia Association for Science Education. Subsequently a meeting was convened under the auspices of the WCOTP at which guidelines for revision were drawn up. The chapter headings are as follows:

Chapter 1 Resources, facilities and techniques for science teaching

Chapter 2 Physical sciences

Chapter 3 Biological sciences

Chapter 4 Earth and space sciences

Appendices include such topics as books and periodicals for the science teacher's library; international system of units; conversion charts; table of elements; periodic table; acid base indicators; relative humidity (percentages); equivalent temperature; logarithms. The new UNESCO Sourcebook for Science Teaching is intended to serve as a source of ideas for the devising of simple scientific activities, investigations and experiments which can be carried out by pupils themselves and for the construction of simple science equipment using materials available in the particular locality where the science teaching is taking place. As local resources differ widely within a particular country, as well as from one country to another, it is anticipated that each teacher will draw from it material appropriate to the needs of his or her own pupils and particular teaching situation.

The book is published by the United Nations Educational, Scientific & Cultural Organisation, Place de Fontenoy 75, Paris 7e, France.

28.3 Experimental work in biology

Three titles in this series are now available: they are

28.3.1	Food Tests by D G Mackean	John Murray
28.3.2	Enzymes by D G Mackean	" "
28.3.3	Soil by D G Mackean	" "

The series are tested laboratory manuals designed for use in the four years leading up to O-level or CSE examinations. Extremely clear instructions are given for carrying out the experimental work and great care has been taken to ensure that all the experiments included have a high possibility of "success", ie that they will give clear-cut "results" on which discussion and questioning can be based. For each experiment a series of questions more or less programmed is given to lead the student to examine the results he has obtained and see just what he is entitled to deduce from them. The student is also encouraged to criticise the design of the experiment, eg the adequacy of the controls. The experiments vary in difficulty and offer a choice to teachers according to the abilities of their pupils of the stage reached in the course. A teacher's guide is available for each book in the form of loose-leaf sheets to be inter-leaved in a copy of the pupils' book. Teachers' guides are 30p, pupils' books 25p.

28.4 Experiments for Young Botanists, by C T Prime, published by G Bell & Sons, price £1.40

The book presents a study of plants and plant life in a clear and practical outline illustrating the processes involved by experiments using simple equipment. It starts with a chapter showing how seeds germinate and the way in which plants grow and goes on to study flower structure and pollination. A simple approach to the study of heredity using Mendel's experiments is followed by work on the crossing and grafting of plants. This leads to an outline of basic plant physiology and plant products; smaller forms of plant life and the use of the microscope to study these are clearly described.

28.5 Outdoor Biology, Published by John Murray, price: Bks 1-3 50p each, Teachers' Bk 80p. Author O N Bishop

This is a series of three books intended for children aged 9-13 and for a wide ability range. Book 1 introduces field work in several habitats. Working in groups the children become familiar with the living creatures of each habitat. Then follows a variety of outdoor projects for individuals or groups. These range in difficulty; most of them are open-ended giving full scope for the development of an attitude of enquiry. The emphasis is on the objective study of living organisms in their natural environment whenever possible. Under the heading "For a rainy day" are some indoor projects useful when bad weather prevents outdoor work.

Book 2 introduces further habitats and more outdoor and indoor projects. Book 3 extends the quantitative work started in Book 2 and draws together some of the ecological ideas which have arisen from the earlier work. There is also a teacher's book which provides suggestions for the organising of field work, discusses the background of the project topics and lists equipment, materials and reference works.

28.6 Keeping animals in the schools - A handbook for teachers, Department of Education & Science, HMSO, price 50p.

An increasing number and variety of living creatures are being kept in primary and secondary schools. They may be regarded simply as classroom pets or as specimens for more detailed study under laboratory conditions. In all cases it is essential that high standards of housing, husbandry and hygiene are established and that children should recognise the necessity for this. The immediate purpose of this pamphlet is to summarise the best of current practices involving animals considered most suitable

for keeping in schools and to suggest some of the educational possibilities that can arise from working with them The pamphlet is divided into three sections which cover the justification for keeping animals in the schools, some general principles of livestock keeping and educational advantage and special environment requirements. The animals are grouped into land invertebrates, fish, pond life, amphibia and reptiles, birds, small mammals and farm animals and poultry A very useful bibliography of reference books forms an appendix.

28.7 Weather & Climate by E Barrett and J Bailey, published by Collins, price 75p

This is a book in the series Certificate Topics in Geography. It is in 8 parts and deals with topics such as physical principles, local weather and climate, Britain's weather and climate, world weather and climate, world weather, climate and man. It also gives temperature and rainfall tables.

28.8 New Trends in Integrated Science Teaching, Volume 1, 1969-70, published by UNESCO, price £2.10

The current move in many countries to unify the teaching of science and the movement to introduce integrated science courses into elementary schools prompted the publication of this new volume in the series on 'The Teaching of Basic Sciences' which were launched by UNESCO in 1967. Elementary school science projects are being developed all over the world and there is much activity in integrated science teaching at the junior secondary school level. There is increasing interest at senior secondary and higher education levels in introducing students to courses in which science is treated as a unified whole, or in which two or more sciences are treated together in a single course. A single volume such as this one can only include selections representing a small fraction of the material available. To attempt to do justice to the widespread development of elementary and junior secondary science this volume concentrates largely on work at these levels. A few significant examples are also included from higher levels and later volumes will give more examples from senior secondary and tertiary level projects. The definition of integrated science is not an easy one and part 1 of this volume contains examples of how various workers have attempted to define it. It also gives some general background relating to the trends towards integration. Part 2 contains statements of the thinking underlying work in progress, together with some examples of this work. Appendix 1, which should be read in association with Part 2, lists many of the projects which may be studied for further information; Part 3 is concerned with the psychological and social factors which must be taken into consideration in planning curriculum changes. Within each part the articles are arranged in alphabetical order of countries of origin except where work in one country is directly related to that of another, either in its approach or in its material. The publication is intended principally for the use of those concerned with science curriculum planning and design and with the education of teachers. It is also hoped that it will serve as a source of information for practising teachers in their efforts to keep abreast of the rapid developments taking place in science education and for students in universities and training colleges who are preparing to be teachers. It is suggested that when workshops on integrated science teaching are planned this publication could be used as a source of information concerning resources which can be drawn upon for such activities The volume has been edited by Mr Peter Richmond, Senior Lecturer in Education, University of Southampton.

28.9 Science Education in Scotland

A small pamphlet has been produced as a supplement to "The Teaching of Science in Secondary Schools 1971". (See SEN 16:14). The booklet was produced in view of the international interest shown in the development of science education in Scotland during the last decade, as it seemed appropriate to give a brief account of the substantial changes in science teaching which has taken place and the circumstances in which these arose. Some mention is also made of the Scottish Educational system found at the time of the Reformation and which has subsequently developed differently from that in England whose State education is only 100 years old. Some of this material first appeared in a school science review article (SSR 1967 166, 48, 685). Headings in the pamphlet include Scottish schools, Scottish science teachers, changes in Scottish science courses, comparison of academic courses in Scotland and England, and it contains reviews of the various science subject courses in Scotland. Copies can be obtained from the Scottish Education Department, St Andrews House, Edinburgh, Scotland.

28.10 Physical Geography

28.10.1 Physical Geography for Hong Kong, by Brian French and Stan Squire, published by the Oxford University Press (first published in 1968). 153 pages. Price 90p.

This book is designed for the use of students in forms IV, V and VI who are intending to sit the Hong Kong Certificate of Education or the University of Hong Kong examinations in geography. Students who are studying for GCE O-level in this subject will also find the book useful. Sketch maps and diagrams have been used liberally both to illustrate the text and to replace the written word. The emphasis throughout this book has been to illustrate the principles of physical geography by using local, ie Hong Kong, examples wherever possible. A selection of exercises appears at the end of each chapter, many of which are from past examination papers.

28.10.2 Physical Geography, Multiple Choice Questions, by Brian French and Stan Squire, published by Oxford University Press, 1970. 56 pages. Price 28p.

The tests in this multiple choice question book closely relate to Physical Geography for Hong Kong by the same authors. Each of the first 9 tests is on topics covered in specific groups of chapters so that it is possible to start using the workbook before the main book has been completed. The final four tests cover work from all sections of Physical Geography for Hong Kong and besides helping pupils to revise their knowledge willprovide useful practice for the Certificate of Education examination, whose syllabus both books follow.

28.11 Oxford Progressive General Science for Hong Kong, Books 1 and 2.

These include a classbook and a teacher's workbook. The authors are J W C Chan and P C C Chen. The books were published by the Oxford University Press in 1969 and 1970. Prices - Books 1 and 2: 85p, 85p. Workbooks 1 and 2: 25p, 30p. The books have been written for forms I and II of Hong Kong secondary schools following a general science course. They aim at providing a sound understanding of scientific principles and try at the same time to inspire a lively interest in the subject at an early age. The authors have included several simple experiments that can be carried out with the

minimum of equipment. They have also made frequent references to everyday experiences and have tried to maintain a logical sequence in the arrangement of subject matter. All biological specimens chosen are local and readily available in Hong Kong. Drawings and descriptions were made from actual specimens. Since English is not the mother tongue of the majority of pupils who will use this book, the grammar and vocabulary have been made as simple as possible. Unfamiliar and difficult English words are followed by their Chinese translations wherever it is thought that this will be helpful. Two versions of the workbook are available in the Oxford Progressive General Science for Hong Kong: one is for the use of students and the other is for the use of teachers. In the teachers' edition specimen answers to the questions in the workbook are overprinted in red. Most of the questions are of the open-ended completion type which will make pupils think generally on what they have read but each chapter also contains five multiple choice questions which test specific knowledge. Ample space has been allowed for the pupils' writing in all the questions on each chapter.

28.12 The New Oxford Progressive Geography for Hong Kong, Books 1 and 2, by C M Speak and A C J Reed, published by the Oxford University Press. Price: Book 1: 65p, Book 2: 80p. Workbook 1: 24p, Workbook 2: 30p, Teachers' edition of workbooks, 24p, 30p.

Book 1 is entitled 'Hong Kong and the World Today'; Book 2 is entitled 'The Developing Continent'. Both years consist of a classbook and workbook.

Book 1 is an introduction to the study of geography in secondary schools. The aim of the authors in this book has been to interest children in the subject. A large number of coloured diagrams, photographs and maps, all closely tied to the text, are included. The use of the workbook, which also contains several sketches and maps, is strongly recommended. This book has been written in controlled English according to a specific grading scheme devised by Mr D H Howe for use by form I students.

Book 2 describes the developing continents of the world, Australia, Africa and South America. The authors make full use of the large number of coloured photographs, diagrams and maps to develop students' powers of observation and deduction. This, and the case studies introduced throughout the book, are intended to interest students in a way which a recital of the facts alone cannot.

The emphasis in workbook 1 is on practical work and personal observation. The authors believe that the interest which this approach is designed to stimulate will help pupils to learn the basics of geography more readily. Although the approach is new much of the work covered in the workbook is standard elementary geography and classes using other courses will also find this book useful. A teacher's edition of the workbook is available from the publisher.

Workbook 2, beside testing simple comprehension and recall, teaches students to interpret the facts of a given situation meaningfully by making diagrams or illustrations and it helps them with the reverse process of appreciating facts from maps.

28.13 Oxford Progressive Science, by P T C Chen

This consists of the following books:-

Modern Science Books 1, 2 and 3 prices in Malaysian Dollars $3.70, $4.50, $4.50 respectively.

The series of three books has been written to cater for the specific requirements of tropical schools. It is especially suitable for Malaysian secondary schools that are following the Comprehensive School Science Syllabus.

The books' content is largely traditional but a practical approach is adopted throughout. The three sciences, biology, physics and chemistry are dealt with in separate sections in each of the books.

28.14 Mathematics in the School

This is a new journal published by the Mathematical Association six times a year. The annual subscription rate is £3.00 a year and application should be made to the Subscription Manager, Longman Group Ltd, Journals Division, 33 Montgomery Street, Edinburgh EH7 5JX. The journal may also be obtained through subscription to the Mathematical Association.

In the editorial to the first edition it is pointed out that during the first hundred years of the Mathematical Association many pleas were made for more articles in the Mathematics Gazette on the teaching of mathematics but it was rarely achieved satisfactorily. The establishment of this magazine is an admission that some new approach is needed and so in one sense this is a brand new venture seeking as its main aim to provide teachers of 7 to 16 year old children with practical and interesting material which has a direct connection with their work in the classrooms. In another sense the origins go back well over 100 years to times before compulsory education when mathematics tended to be the preserve of the public schools. Times have changed and the type of mathematics teaching given and required has changed with it. Definite progress has been made and nearly all children of all ages do mathematics now rather than the dull arid arithmetic of former years. One way in which Mathematics in the School differs from other publications of the Association is that it sets out to be a discussion medium. Reports and Gazette articles tend to be authoritative statements whereas this journal hopes to print work in progress which will benefit by public debate; it offers a platform where ideas can be floated and prejudices can be aired.

A quick glance at the contents of Volume 1, No 1, issued in November 1971 gives point to the above editorial. It contains articles on "The Rise of the Mathematical Association 1871-1897" by J T Combridge; "The teaching of fractions in mixed ability groups" by G Sampson; "Mathematics for Majority Continuation Project" by Peter Kaner and "Apparatus Review" by D J Maxwell, amongst others. A pretty wide range of material is offered. This journal will be welcomed by teachers of mathematics in the UK and will be of considerable interest to people developing new mathematics courses overseas.

28.15 Metres, Litres and Grammes - Introducing Metrication in the Primary School, Schools Council, Evans/Methuen Educational, price 30p.

The Metrication Board in the United Kingdom through its Steering Committee for the Educational & Industrial Training Sector has collaborated with the Schools Council in the production of this guidance booklet for teachers in primary schools on the introduction of metric units of measurement. The full benefit of metrication will not be felt in primary schools until Imperial units cease to be in general use. The transitional period imposes particular requirements which have been kept in mind in framing the advice offered in this pamphlet. The pamphlet offers suggestions on the introduction of the ideas of measurement in metric units; it suggests apparatus and equipment for this purpose and gives instruction on ways of writing metric measures and of carrying out practical work and calculations in metric systems. The problems of application of metrication to everyday life are touched on, as are derived units of practical size and SI units.

28.16 "Educational Technology: the design and implementation of learning systems"

This report is based on the work of CERI, the Centre for Educational Research and Innovation, in the field of educational technology and on the results of a workshop on "Educational technology - strategies for implementation". The workshop was organised by CERI in conjunction with British, Dutch, German and Swedish authorities at Leyden, Netherlands from 19-25 April 1970. The book has been published by the Organisation for Economic Co-operation and Development in 1971 at £0.92. The report shows that educational technology is not a bag of mechanical tricks but the organised design and implementation of learning systems; taking advantage of, but not expecting miracles from, modern communication methods, visual aids, classroom organisation and teaching methods.

The report is written in two parts. The first part concentrates on presenting a general survey of current issues and trends in educational technology and of the design and evaluation of learning systems. Against the background of part 1, the second part of the report goes on to deal with some practical issues on which guidance is offered to those concerned with educational innovation. One of the appendices contains a list of background papers which are available on request from OECD/CERI, Paris.

28.17 "Seminar on Computer Sciences in Secondary Education", published by OECD in 1971, price £1.90.

The aim of CERI work on computer science in secondary schools is to assist OECD countries to co-operate in accomplishing such development work thereby providing a wider range of information, experience and development results than they can individually muster, no doubt also to inspire some countries to tackle this problem sooner and more systematically than would otherwise be the case.

This report has been prepared following an international seminar which was organised with the assistance of the French authorities at Sevres, near Paris, in March 1970.

The report consists mainly of a series of papers given by international experts in computer sciences in secondary education. Titles of papers include 'Curriculum Development in Computer Science', 'Suggested contents for courses in computer instruction in secondary schools', 'Present provisions of computer education in secondary schools in the United Kingdom', 'Training of teachers to use computers in instruction' and 'Suggestions for the emergency training of teachers in computer education for the years 1970-72 and for the establishment of regular courses from 1973'.

28.18 "Training of University Teachers: a survey of its provision in universities in the United Kingdom", by Harriet Greenaway, published by the Society for Research into Higher Education Ltd, 20 Gower Street, London WC1, July 1971. Price £0.50.

Harriet Greenaway is Administrator of the Society for Research into Higher Education (SRHE) and was the organiser of the York Conference on The Training of University Teachers. In September 1970 the Governing Council of the SRHE decided that the Administrator should obtain consistent and comprehensive information from every UK university about

the history of its training with details of courses provided in the past and planned for the 1971/72 session. This pamphlet is the result.

The contents of the pamphlet include details of training in each university (both descriptive and tabular), courses available for people from other universities to attend, names of contacts and index of universities.

28.19 Museums in Education: Education Survey 12 by the Department of Education & Science, published by HMSO, price 50p.

This is a report on the survey carried out by HMI and attempts to examine the contribution of museums to education and suggest how available resources might be better used. The survey describes the range and variety of educational activity promoted by those museums and museum services with which it was concerned. Examples given are selective and not exhaustive. The survey is made under such headings as:

The implications of educational development

Teaching in museums

Museums and adult education

Scope for development

Loan services

Lecture services

Suggestions for the future

28.20 British Council SCIREFS

The following new SCIREFS have been issued and copies are available from local British Council Representatives:

SCIREF 11 A list of modern British mathematics curriculum project materials

SCIREF 12 A list of modern British science curriculum project materials

SCIREF 20 A list of chemistry books for teachers.

29. SCIENCE EDUCATION ABSTRACTS

29.1 A Comparison between Teaching Methods in Secondary School Biology, P J Wilton, S J Whittle and D C B Teather, Journal of Biological Education, Vol 5, No 4 August 1971, page 179.

This article compares the effectiveness of a section of a published programme learning test in biology with that of a more conventional lesson in three London secondary schools. A major contribution of programmed learning to education and training has been to encourage the study of the relative effectiveness of different teaching methods. Many students have compared programmed learning with traditional teaching and have revealed that programmed learning judged by objective tests is at least as effective as traditional methods and often takes less time. The article suggests that the experimental designs employed in many of these studies, however, are open to criticism and the authors contend that in their view one of the most serious shortcomings is that the effectiveness of the teaching method has usually been assessed by verbal recall of factual information rather than by the application of information of novel but related situations. The work described in this article was undertaken to compare the effectiveness of a section of high quality published programmed text with that of a well-prepared lesson in secondary school biology. Effectiveness was judged both by tests demanding recall of factual information and by a test which demanded the application of knowledge to novel but related situations. Objective impressions of learning environments were included where relevant. The work is that of the case study relating to the general question 'How successful are published biology teaching programmes when used in the schools?' A detailed account of the method and of the results obtained is given. The authors are aware of the limitations of this study in respect of the relatively small number of pupils in each group and the short length of the learning period. The novelty effect of programmed learning may also have presented problems but may have been offset by the novelty of new teachers in the control lessons. The authors comment that no significant differences due to teaching method were obtained from the results of any of the tests. But marked differences were found between the schools although the performance and attitudes of the control and programmed learning groups within each school were remarkably similar.

29.2 The Educational Use of Living Organisms, P J Kelly and J D Wray, Journal of Biological Education, Vol 5, No 5, October 1971, page 213.

A characteristic feature of most recent developments in the teaching of biology and allied subjects is the emphasis put on the use of living material. It applies to all levels of education and has established a considerable potential need and a perceptibly increasing demand for greater numbers and a greater variety of organisms. In recent years there has been a tendency to avoid "type" teaching in biology courses and this allows a greater variety of organisms to be used. The Nuffield A-level and O-level biology projects for example list over 50 species for use in their courses, although it should be pointed out the cost of upkeep of some of these is negligible. This article describes a survey made in 257 secondary schools and 84 primary schools in 18 local education authorities on the subject of the use of living organisms; covered the range of organisms being maintained in primary and in secondary schools and looked also at the facilities available in the schools. The article then goes on to discuss the needs of the school in this context. One of the authors, Mr J D Wray, is the Director of the Schools Council Project

for the Educational Use of Living Organisms which is based at the Centre for Science Education, Chelsea College, Bridges Place, London SW6, England. The article summarises the needs of the schools in three contexts: the need for information based on careful evaluative studies of the educational value and maintenance facility of various species geared to establishing rational rather than haphazard policies by which teachers can determine their use of organisms; the second need is for organisational arrangements to overcome the problems of maintenance during holiday periods; and a third requirement is a long-term one - it is for purpose-built organism accommodation in schools.

29.3 The Effects of Three Teaching Methods on the Ability of Young Pupils to Resolve Problems in Biology: an experimental and quantitative investigation, S Heaney, Journal of Biological Education, Vol 5, No 5, October 1971, page 219.

This article describes an investigation carried out with the co-operation of 12 teachers in Staffordshire Schools to examine the effects of three teaching methods on children's learning from a curricula unit in biology. The three teaching methods examined were:

Method 1: Heuristic: guided discovery

Method 2: "Cook-book": children were busy following a cookery recipe

Method 3: "Didactic with demonstrations": pupils listened to and watched their teacher.

The study found that the Heuristic method was more successful than the "cook-book" and the didactic with demonstration methods for a. the development of problem solving skills when pupils were tested as an integral part of their learning from the curricula unit; b. improvement made by pupils as measured on pre- and post- course tests in problem solving skills; reasoning and recall of biological knowledge; practical laboratory skills. c. recall and application of problem solving skills in knowledge to problems in biology that the pupils had not previously experienced.

Full details of the experiment are given and the author concludes that research adds evidence to support the inclusion of heuristic teaching when this is characterised as "guided discovery" giving the pupils experience of using scientific method in the solution of problems. By learning in this way pupils gain an understanding of the essential nature of scientific enquiry. Heuristic teaching does not only aid cognitive development but also helps pupils to gain knowledge.

29.4 Evaluation Studies of the Nuffield A-level Biology Trials. 1. Overall achievements of students, P J Kelly, Journal of Biological Education, Vol 5, No 6, December 1971, page 315.

This article is the first of a series outlining the findings of the evaluation studies conducted during and just after the trials of the Nuffield A-level biology project. Accounts of the materials and scheme produced by the project for the trials after revision of the overall strategy of evaluation and of the methods of assessment and examination employed have been reported elsewhere. In this article emphasis is placed on the findings of evaluation that contributed to the redesigning of the scheme and which appears to have significance for biology teaching in a wider

context, particularly for the extended evaluation studies that will be required from 1972 onwards when students will be taking A-level examinations based on the revised and commercial editions of the project's publications. The article describes the sample of schools used and the objectives of the trial course in outline. The nature of achievement in the context of the A-level biology course is discussed and the methods by which the data used in evaluation were obtained are described. An analysis is given of the examinations held in 1967 and 1968 and the author offers some conclusions on the importance of evaluation work of this kind in curriculum development in general. In an appendix full details of the sample and comparison with previous achievements in biological sciences are given.

The Journal of Biological Education is published six times a year for the Institute of Biology by Academic Press Incorporated (London) Ltd, subscription rates for overseas $10 plus $1.10 postage. Subscription orders may be placed with Academic Press Incorporated (London) Ltd, 24-28 Oval Road, London NW1 7DX, with the exception of those originating in the USA, Canada, Central America and South America which may be sent to Academic Press Incorporated, 111 Fifth Avenue, New York, NY 10003, USA.

29.5 Safety and Science Teacher Training, E W Jenkins, Education in Chemistry, Vol 8, No 4, July 1971, page 132.

Safety is probably one of the few topics which everyone would agree should form part of the curriculum of intending science teachers but it is doubtful whether much general agreement exists about those aspects of laboratory safety which should be studied within the time available. The law takes the view that a science teacher must act as would a reasonable parent with expert knowledge but such a view is of little help in trying to decide the objectives, content or methodology of a course in safety as part of the professional preparation of science teachers. This article argues that although school science laboratories seem to have been remarkably safe places in which to work in the past there is good reason to believe that present levels of safety risks might rise rather than fall. It then goes on to survey this problem from the point of view of objectives for a teacher training course and the methods which might be employed to help student science teachers understand the problem of safety in laboratories. Methods suggested include a safety quiz, case studies, the use of audio-visual aids as well as a detailed study of experiment and procedures. The article suggests that there is a need for an authoritative safety handbook for the school science teaching profession, particularly since some of the hazards met in school laboratories are unlikely to occur elsewhere.

29.6 Conceptual Demands in Nuffield O-level Chemistry, R B Ingle & M Shayer, Education in Chemistry, Vol 8, No 5, September 1971, page 182.

In the light of estimated conceptual levels for each of the topics in the Nuffield O-level chemistry course, suggestions are made for modifications to the sample scheme which may be necessary to provide courses for pupils of different intelligence. For each sub-topic of the Nuffield sample scheme an attempt has been made to answer two questions: 'What is the minimum conceptual level that a pupil must have attained without which his interest cannot be sustained'; 'What conceptual level is needed to enable the pupil to comprehend the course in a well-integrated way - for this he must grasp the chemistry of the sub-topic in relation to the course as a whole'. The article presents in diagrammatic form

and with comment answers to these questions. It also illustrates how the assessment was applied and comments on levels of difficulties. The article closes with the suggestion for use of the model proposed as a means of analysing and possibly restructuring courses so that pupils meet appropriate difficulties at appropriate ages.

29.7 Chemistry in Europe - Aims of Chemistry Teaching, J J Thompson, Education in Chemistry, Vol 8, No 5, September 1971, page 170.

Chemistry in Europe - Chemistry in the Secondary School Curriculum, J J Thompson, Education in Chemistry, Vol 8, No 6, November 1971, page 217.

While the countries of Europe are moving towards closer economic and political unity their educational systems remain highly individualistic. These two articles are part of a series on aspects of chemistry teaching in Europe.

The aims and objectives of chemistry teaching at the most advanced level in secondary schools throughout Europe have been investigated recently in a survey carried out on behalf of the Council of Europe. The first article in this series, dealing with the aims of chemistry teaching, considers in some detail the results of a questionnaire on objectives of chemistry teaching in seven European countries: The Federal Republic of Germany, Ireland, Luxembourg, Italy, Sweden, Turkey and England and Wales. A detailed inspection of the objectives obtained either by questionnaire or by a survey of current literature reveals that a consensus can be reached on a substantial number of aims and the article goes on to produce a short list of such a consensus.

During the past 20 years most European countries have experienced a substantial reorganisation of their secondary school system and many of these have developed along comprehensive lines. Understandably this reorganisation has had an effect on the place of science subjects in the school curriculum and with the need for an increasing number of scientists and technologists to meet the demands of present-day society, changes are still taking place.

The second article in this series examines when, for how long and to what extent chemistry forms part of the secondary curriculum day in the schools of Europe. An interesting series of comparisons is obtained which shows that approximately half of the survey countries have courses in which first chemistry teaching takes place as part of an integrated science course preceding the teaching of science as separate subjects. By the time most students are 15 years old they would study chemistry as a separate subject. The age, however, at which the teaching of chemistry as a separate subject begins varies considerably. The article also considers the lengths of chemistry courses and the number of hours devoted to the study of chemistry in different countries and also the variety of science courses offered, particularly in the final 2 years of secondary schools in which chemistry appears to feature largely in most of the combinations. The article concludes with some comments on chemistry courses for non-specialists in the countries of the survey.

29.8 Topic Difficulties in Chemistry, A H Johnstone, T I Morrison, and D W A Sharp, Education in Chemistry, Vol 8, No 6, November 1971, page 212.

Many, if not most, teachers would claim to have an intuitive feeling for what is right and good for their pupils. This belief has been the basis of syllabus reforms in chemistry over the past decade and groups of

teachers have consulted together and produced one new syllabus after another. Admittedly the courses were tried out in pilot schools but the results of the trials were often open to doubt as the participating teachers were often evangelically zealous in ensuring that the new courses should succeed. Ten years have gone by since the introduction of the new Scottish syllabuses in chemistry and the surveys described in this article were undertaken to obtain an objective picture of the success of these courses as seen through the eyes of the pupils and knowledge of the problem areas exposed may be useful to all teachers and curriculum planners since it is likely that these difficulties are not restricted to Scotland. The article then goes on to set out in some detail the results of a number of questionnaires on such things as pupils' reactions to some O-grade topics; a comparative result of O-grade students in objective tests with the degree of difficulty they thought they had experienced in the same topics; students' reactions to course topics in the Certificate of VIth year studies; reactions to concepts in the Certificate of VIth year studies and the results are discussed in some detail. The article concludes with the comment that these surveys have raised some pertinent questions which teachers ought to consider: are certain topics appearing too early? are new methods of teaching required for some topics? should the pace be slackened when certain topics are attempted? should difficult topics be introduced gradually to meet intermediate needs rather than be taught in a block? are syllabuses too full so that some teaching has to be rushed? The answers to these questions will not be easy to find but it is important that they should be posed and detailed analysis made of the problems which they raise.

Education in Chemistry is published by the Royal Institute of Chemistry and the Chemical Society in January and alternate months each year. The subscription rate is £5.00 per annum, single copies £1.25, and enquiries regarding subscriptions should be addressed to Chemical Society Publications, Sales Office, Blackhorse Road, Letchworth, Herts SG6 1HN, England.

29.9 Teaching Physics on a Limited Budget, W H Jarvis, Physics Education, Vol 6, No 2, March 1971, page 85.

More for Your Money, J Jardine, Physics Education, Vol 6, No 2, March 1971, page 89.

The last 10 years have brought a wealth of new physics teaching apparatus but much of it is beyond the means of small schools and many schools overseas. These articles describe ways of cutting costs in the teaching of physics. The articles draw their ideas and inspirations from a number of sources in addition to the experience of the authors themselves; for example, the Association for Science Education members exhibitions and the activities of the Scottish Schools Science Equipment Research Centre (SSERC). The article by Mr Jardine underlines that there are of course some basic requirements and much of the apparatus in any physics laboratory will have to be bought from the normal suppliers. This includes such things as glassware, hardware, Newton balances, electromagnetic kits and lenses. Perhaps the best way of saving money on physics equipment, says Mr Jardine, is to devise a practical course in which pupil experiments are based on well-made but relatively cheap appratus which is used over and over again. The article then lists items which attempt to fit into this category and covers electricity, mechanics, waves and optics in particular and gives a list of the suppliers of the components included.

29.10 Thinking Quantitatively, J W Warren, Physics Education, Vol 6, No 4, July 1971, page 238.

Quantitative thinking is of the utmost importance in most branches of natural and applied science. It is essential for physicists and it is through training in physics that workers in other fields could most suitably be instructed in this skill. The habit of thinking quantitatively and appreciation of the probable magnitudes of physical quantities can be developed by direct instruction and through well planned laboratory work, but the working of numerical problems is most important. Unfortunately, says the author, such problems are too often regarded merely as exercises in calculation and in the recapitulation of formulae. The author then goes on to describe some absurd problems which have been used to test students in the past and surveys a number of fields in which experiments and calculations have produced results which would be quite impossible in actual practice. The author concludes that numerical problems can be used to teach the magnitudes of physical quantities; sometimes this is overlooked, however, and instead the problem is purely an exercise in the calculation of the result which is not expected to have any particular meaning. The author of this article is also the author of the well known book on "The Teaching of Physics" published by Butterworths which expands in some greater detail on problems of this kind.

29.11 An Analysis of the Educational Process Appropriate to the Education of Graduate Physics Teachers, D R Chapman, Physics Education, Vol 6, No 5, September 1971, pages 376.

A great deal of attention is being paid to teacher education in the United Kingdom at the present time. The author sets out to examine the problems facing the production of trained graduate physics teachers. He surveys the boundary conditions of the task, the pattern of initial graduate teacher education and suggests that the consensus of opinion at the present time appears to be in favour of consecutive rather than concurrent teacher education at graduate level. For a number of reasons, the Postgraduate Certificate in Education will probably continue to be the only period in which vocationally oriented education impinges on the majority of potential physics teachers. The problem is how to ensure that the period of study has maximum value for the future teacher. The attitude of physics education to their work is studied and reference is made to the Association of Department of Education Physics Tutors which was formed about six years ago to facilitate the inter-change of ideas on courses, teaching methods, school practice arrangements etc. Having surveyed these two factors the author then looks at the development of a satisfactory course of physics teacher education itself and suggests that the analysis which he presents, if acceptable, would mean that the development of a satisfactory course becomes much more a matter of developing an appropriate learning environment than a problem of content. He looks at the use of small tutor groups as a method of preparing the physics teacher, and comes to the conclusion that at least a minimal amount of course structuring is necessary. In conclusion the author points out that although the article is concerned with the problems of initial teacher education the needs of in-service teacher education must be looked at and these are rather different. The article concludes by posing a number of fundamental questions in relation to the task of the physics teacher and suggests that perhaps the time has come to take a further look at the size of laboratory classes and the work-load of teachers.

29.12 Electronics in the Nuffield Advanced Physics Course, G E Foxcroft, Physics Education, Vol 7, No 1, January 1972, page 14.

With the very rapid growth of the electronics industry and the rapid development of a wide variety of electronic devices it is not surprising that modern developments in physics teaching, particularly at advanced level, have tended to include elements of advanced electronics. The author points out that the problem of whittling down the content of an advanced level course to a size which could realistically be tackled in the time available might have suggested the exclusion of electronics. However they suggest that at least three gains are to be made from doing some electronics. Firstly, if the behaviour of reactive circuits are included, then it would use and extend work on resistance, capicitance and inductance done earlier in the course. Secondly, a large majority of sixth form pupils studying physics will eventually find careers in scientific or technical spheres in which they will use electronic devices. Thirdly, it could give the opportunity for a new style of work, a style reflecting the problems of the engineer rather than those of the physicist, a synthesis of parts for a purpose rather than the analytical approach of much of the other sections of the course. It was decided therefore to allow about 10% of the available time to the topic 'Electronics and Reactive Circuits'. The article then goes on to describe the route chosen to teach the electronics work and some of the apparatus used for this. It then describes the basic structure of the electronics component of the Nuffield A-level course and immediately following the article is an item called 'Physics apparatus' which includes information on the apparatus for the electronics experiments mentioned in Mr Foxcroft's article arranged in alphabetical order of manufacturers.

For those interested in further elements of teaching the electronics in schools this same issue of Physics Education contains a number of other very useful articles, notably the following:

'An elementary practical course in electronics for science students', R G G Leckey, page 23,

'Electronics for the majority', E F Hughes, page 27,

Physics Education is published bi-monthly by the Institute of Physics, 47 Belgrave Square, London SW1X 8QX, England. The subscription rate for all countries except the United States, Canada and Mexico is £7.00 pa; orders should be sent to Physics Trust Publications, Blackhorse Road, Letchworth, Herts, England. Orders from North American countries should be sent to the American Institute of Physics, 335 East 45th Street, New York, NY 10017, USA.

29.13 Science as General Education, D Layton, Trends in Education No 25, January 1972, pages 11.

The author suggests that it is possible to discern three stages in the development of school subjects beginning from the point at which the subject first appears on a time-table, justifying its presence on grounds such as pertinence and utility and where the dominating criterion for the selection of subject matter is relevance to the needs and interests of learners. This the author suggests is often accompanied by the use of teachers who are rarely trained specialists but bring the missionary enthusiasm of pioneers to their task. In the second stage, he suggests a tradition of scholarly work in the subject emerges along with a core of trained specialists from which teachers may be recruited. Students are still attracted to the study but as much by its reputation and

academic status as by its relevance to their own problems and concerns. Internal logic and discipline of the subject becomes increasingly information on the selection and organisation of the subject matter. The third stage would be characterised by a further advance along the road of centralization and expertise. The teachers now constitute a professional body with established rules and values, the selection of subject matter is determined in large measure by the judgements and practices of specialist scholars who lead enquirers in the field. Students are initiated into a tradition; their attitudes approaching passivity and resignation are a prelude to disenchantment. The author suggests that science, which in many schools entered the curriculum because it represented useful knowledge, would in recent years seem to have achieved the third stage of development. He goes on to suggest that science has now, like Classics, to re-establish itself as an effective instrument of general education since it would seem to have allowed the applications of scientific knowledge to the wealth of man and the characteristics of science as a mode of intellectual enquiry to be overlaid by the weight of formal exercise and historical accretion.

Looked at in this light it is possible to regard Nuffield O-level biology, chemistry and physics as not ushering in a significant period of curriculum reform but more properly as signalling the end of an era. They round off just over a century of science education in which the emphasis has been placed in varying degrees on the achievement of two broad objectives: first, an understanding of the conceptual structures of science - science as a body of knowledge - and, second, an understanding of the procedures of science - science as a process. The author then goes on to argue that perhaps we should question ourselves as to which objectives of science teaching we really want to achieve in general education. The article surveys the question of science as a social policy and its implications for the curriculum. The analogy with the classicists is repeated in that it is suggested that scientists might ask the question 'How much knowledge of the procedures and conclusion of the various sciences is necessary in order to achieve an understanding of the relations of science, technology and society?' The author suggests that it is probable that a series of new courses in science studies at various levels might reasonably be generated to answer the new needs in the use of science as general education.

Trends in Education is published by the Department of Education & Science, Curzon Street, London W1, England. The annual subscription for four quarterly issues is 84p.

29.14 Science Teaching and Educational Technology, Part I, P J Hills, School Science Review, Volume 52, No 180, March 1971, page 493.

Science Teaching and Educational Technology, Part II, P J Hills, School Science Review, Volume 53, No 182, September 1971, page 14.

In the first article the author commences his survey of this aspect of the development of science education by contrasting the formal disciplined, rigid training and learning by rote which composed a large part of the ideas of J F Herbart (1776-1841) with modern attitudes towards the teaching/learning situation such as those expressed by Professor E M Rogers which place a great emphasis on the pupil understanding what is being learned. The author suggests that it is only in the last 10 years that the excessive formalism of the past has begun to give way to an appreciation of the needs of the learner. He compares the swing from dogmatic science teaching to teaching for understanding with the developments in audio-visual aids and programmed learning movements. In recent years the

use of audio-visual methods and the application of programmed learning techniques has shown a gradual swing from the insistence on the importance of mechanisms of the hardware to an awareness of the need for improving the content material of the instruction. This parallels the idea of teaching as merely a way of imparting facts to mass classes changing to a view of teaching as needing to consider the needs of the individual. In the second article the author considers educational technology and the systems approach. He suggests that whereas educational technology is often equated with the use of audio-visual aids it is in fact much more than this: it is concerned not only with the hardware and the software of educational media but also with the whole structure of the educational process. Educational technology can be thought of, says the author, as the coming together of four main developments in the field of audio-visual aids, modern learning theories, programmed learning and the systems approach. He then goes on to analyse this thesis and to consider the factors which the system should take into account. He describes the design and use of self-teaching material in use at the University of Surrey and suggests that the results of the use of this material and the work being put into its design provide added support to the following basic facets which emerge from this philosophy of educational technology:

29.15.1 That teacher-centred courses should give way to learner-based systems which attempt to show the individual his problems and provide a means whereby he can solve his own problems.

29.15.2 That audio-visual methods can be used effectively in self-teaching situations but that their appropriateness for a particular task needs to be firmly established.

29.15.3 The application of a system approach as defined elsewhere in this article can provide the basis for the design of courses in terms of specific behaviour of objectives and the evaluation of these courses in terms of the objectives.

The School Science Review is published by the Association for Science Education, College Lane, Hatfield, Hertfordshire, three times a year. The annual subscription is £4.00 including postage inland or abroad.

29.16 Mathematics Through Imagination, C Ormell, Diaglogue No 9, Autumn 1971, page 10.

Up to about 15 years ago there were three well known theories about the nature of mathematics: the logistic, formalist and institutionist theories. Then the electronic computer arrived and our ideas about what constituted mathematics began to change. The author suggests that the result has been that the three established theories about the nature of mathematics have come to seem to be increasingly irrelevant and a completely new conception of what mathematics is and what it does has begun to emerge. The new outlook is not based on the work of any one individual but on a new attitude to mathematics which has arisen spontaneously out of the work of mathematicians and scientists working with computers. It has not yet acquired a suitable name but it is often referred to as the 'model view' of mathematics. The 'model view' of mathematics is that mathematics is a kind of Kit of apparatus from which symbolic models of situations can be constructed. The article goes on to consider this definition and its implications for the changing role

of the mathematician itself and suggests that the changes clearly imply a change in emphasis in our thinking about the mathematical curriculum. Technique for the sake of technique is no longer what society needs but 'concept for the sake of concept' is a prescription for mathematicians' mathematics. The author suggests that all good teachers of mathematics will no doubt weave into their teaching something of the fascination of mathematics as an aesthetic activity but the presentation of mathematics as being essentially an aesthetic exercise will hardly do. The article argues that imagination is the link between ordinary thinking and applicable mathematics and some interesting examples of this approach are given.

Dialogue is the Schools Council Newsletter and is available from the Schools Council, 160 Great Portland Street, London W1N 6LL, price 15p overseas.

OVERSEAS ACTIVITIES

30. AUSTRALIA

The Australian Science Education Project (ASEP) (See SEN 14:26)

The following information has appeared in the ASEP Newsletter No 4, November 1971:

Teacher participation in trials There will be 7 teams established in each State for the national trial of those units ready for trial in the period February to August 1972. Each team will consist of a team leader, who will work closely with the trials co-ordinator in conducting the trials, and up to three other members. The team leader will have the position as junior co-ordinator in a school and will be an experienced science teacher who has volunteered for the position. Members of each team will come from schools close to that of the team leader so that the team can meet regularly and will be representative of the various types of teachers and schools in each State. For example, it is hoped to have a young teacher in the team who has just taken up a teaching position after training.

Units for National Trial The units to be placed on national trial in the order that they are likely to become available over the period February to August 1972 are:

"Pushes and Pulls", and "Mice and Men", Stage 1;

"Life in freshwater", and "Light forms Images", Stage 2;

"Messengers", "Safety", "The world of the soil", all Stage 1 units;

"Microbes", Stage 2

"Plants", Stage 1

"Charge!" Stage 2

"Pigments and acidity", Stage 1.

From time to time State trials co-ordinators will be giving information on the progress of these trials through science teacher and departmental publications. Science teachers are urged to keep in touch with ASEP through the national trials in their own particular State.

31. GHANA

31.1 Mathematics Workshop

The British Council sponsored a visit to Ghana by Mr Arthur Hurrell, who is mathematics master at Marlborough College, from 28 December to 8 January 1972. The purpose of Mr Hurrell's visit was to attend the VIth form workshop at Mfantisipim school from 31 December to 3 January. There were three main topics at the workshop:

31.1.1 Preparing a brochure to explain the aims of the VIth form mathematics project group books and to give teachers some guidelines into the teachers' guides until the teachers' guides can be prepared.

31.1.2 Deciding whether or not there was any possibility of collaboration between Ghana and Kenya in preparing the text.

31.1.3 Discussing the A-level statistics and probability chapters in the SSMPG books 1 and 2.

A total of 45 attended the conference.

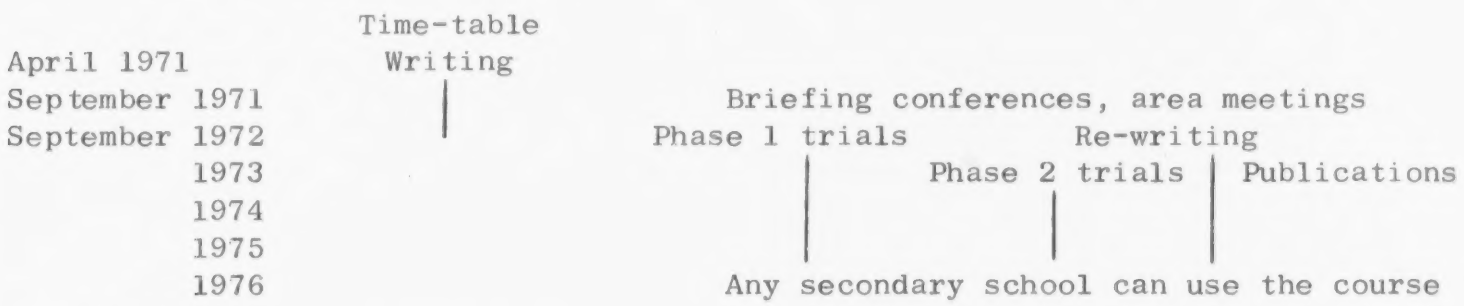
31.2 Decisions of the Project for Science Integration (PSI) Workshop April 1971 (See SEN 16:20b)

There will be a pilot scheme in 2 stages:-

Phase 1 will involve a small number of committed schools in order to find out whether the course will work under the best conditions. The schools should be readily accessible to members of the Junior Secondary Group when the trials are in progress.

Phase 2 will follow one year behind Phase 1 and will involve a cross-section of schools, in order to discover the problems of the course under various working conditions.

During the trials there will be briefing meetings/evaluation meetings, probably at intervals of two months or half a term. Materials given to trials schools should be free and as near as possible to those intended for final publication.



PSI Workshop 15-18 December 1971

Three types of session were organised; group, laboratory and general. A discussion session on the problems of assessment and evaluating was led by Dr L Skurnik of the West African Examinations Council. Another session led by Dr H Dyasi of SEPA was devoted to a discussion of the Science Education Programme for Africa, the role it is playing and how it might assist the work of PSI in the sphere of teacher training.

It is planned to have another workshop around Easter 1972 when all tutors etc will meet to review the first term's work. Also, it is hoped to produce a booklet along the lines of the Nuffield Junior Science Teachers' Guide 2 as a way of reporting the results.

32. INDIA

32.1 Indian Science Education Journals

In February 1970 the National Council for Science Education (NCSE) produced the first issue of a new Journal - The Indian Journal of Chemical Education. The production of such a Journal had been one of the recommendations of an International Chemical Education conference held at Srinagar in 1969. This Journal has now been followed by two others, The Indian Journal of Technical Education (July 1971) and the Journal of Physics Education (September 1971). The latter journal grew out of proposals made

at the 1970 conference on Physics Education and Research at Srinagar These journals represent important initiatives in their respective fields in Indian Education and promise to make a valuable contribution to the dissemination of modern ideas and methods and to improve considerably the means of communication in Science Education throughout the sub-continent The NCSE also produces its Science Resource Letter three times a year. Further information on these publications can be obtained from the Office of the Chief Executive, The National Council for Science Education, 9 Ring Road, New Delhi, India.

Two other Indian Science Education journals of note are VIGYAN SHIKSHAK, The Science Teacher, produced quarterly by the All India Science Teachers' Association, NIE Building, Mehrouli Road, New Delhi 16, India, and School Science, produced quarterly by the National Council for Education, Research & Training (NCERT), Sri Aurobindo Marg, New Delhi 16, India.

32.2 Maharashtra State Revised Mathematics Syllabus

The Bombay Science Education Newsletter No 5 has a section on the New Mathematics Course being introduced into Maharashtra State Secondary Schools beginning from Std VIII in June 1972.

The Mathematics and Science Teachers' Club, Bombay is going to organise a series of lectures on "New Mathematics and its teaching". The lectures will be supported by discussions, workshop type activities and assignments resulting in a work book for teachers.

Anyone interested should contact:-

N N Shukla
President
The Mathematics and Science Teachers' Club
H J College of Education
Samshodhan Sadan - South Avenue
16th Road - KHAR - BOMBAY 52 AS.

33. JAMAICA

33.1 Association of Science Teachers in Jamaica

In January the Constitution of the Association was revised and the Association now consists of the Executive and Regional groups. A Regional group is defined only as consisting of not less than 10 members. There are already three flourishing groups of science teachers which meet approximately monthly. Accompanying the meetings are often lectures by members or guest speakers to members and frequently their pupils. These gatherings provide opportunities to discuss current problems, share ideas, borrow equipment and potentially to have a strong voice in the progress of science education in Jamaica. These groups will now be deciding whether they wish to become Regional groups.

The Association produces a newsletter monthly during the school year for fultime teachers in secondary school and this is produced from the Science Centre for Schools, c/o The Department of Physics, University of the West Indies, Kingston 7, Jamaica, West Indies.

33.2 Science Centre Newsletter (see SEN 14:29)

Some useful items of information are featured in the newsletter of January 1972 produced by the Science Centre for Schools, Kingston, Jamaica of notes on apparatus, where it can be serviced and where it may be obtained, apparatus on display in the Science Centre; an article on curriculum devoted to the Intermediate Science Curriculum Study; some useful notes on experiments and, finally, book reviews.

34. MALAYSIA

Curriculum Development in Science and Mathematics

Malaysian Education Authorities have been particularly active in the development of modern science and mathematics courses for some years. A number of these courses are now making significant impacts in the schools and their implementations spreading to a larger and larger number of schools throughout the system. In addition to its development of science and mathematics courses, the Government of Malaysia has decided that the medium of instruction in schools will become the national language, Bahasa Malaysia, and this programme of conversion to the national language has now reached the third form of the primary school and will continue up the school each year. A National Curriculum Development Centre will be set up shortly.

34.1 Primary level A programme to upgrade and enrich the teaching of mathematics and science in the primary schools and especially those in rural areas was initiated in 1968. The programme has written and distributed guide-sheets for the teaching of primary mathematics and science using modern discovery approaches and the programme has and is providing in-service training at State levels to teachers using the guide-sheets in order to ensure that the teachers fully understand the rationale and the methodology stipulated in the guide-sheets. In addition communication between the development centre and the teachers in the classroom for feedback purposes and evaluation has been established. The work on the standard 3 syllabus will be completed by the end of 1971 and it is intended that this programme should cover the whole of the primary schools. A special writing team is convened in Kuala Lumpur for the purposes of this project under the direction of Enche Abu Hassan bin Ali at the Science Centre.

34.2 Lower Secondary level Malaysia has introduced integrated science and modern mathematics courses on a trial basis in its lower secondary schools. In the case of science, the Scottish Integrated Science Scheme has been modified to meet the Malaysian needs and expanded to fill the three years of the lower secondary level courses in Malaysia. The integration of physics, chemistry and biology in science teaching is a new idea to Malaysia and great emphasis is laid upon the practical work guided by work-sheets in the Scottish materials. The major programme of in-service courses for teachers has therefore been necessary to undertake the implementation of this work. The first junior secondary certificate examination for the new courses was held in 1971 and larger and larger numbers of schools are at present undertaking the course. A programme of development of laboratories and the training of laboratory assistants is also being implemented parallel to the in-service training of teachers. This has been made particularly necessary by the emphasis on practical work in the integrated science courses. The introduction of this work has been assisted by a team of tutors from the Scottish Education Department under the direction of Mr A W Jeffrey HMI. The work which was originally designed for use in Scottish schools has been redesigned for use in Malaysia and progress is now being made in writing a pupils' text for use as supporting material, based on Malaysian conditions and the Malaysian environment where appropriate.

The curriculum activities in mathematics for the junior secondary school have kept pace with similar activities in science. In 19[illegible] Committee was set up to consider a new syllabus in the light of the changes taking place in mathematics education. The syllabus produced was largely influenced by the work of the Scottish Mathematics Group and aims to provide a useful experience of mathematics for those pupils who will terminate their studies at the lower secondary level, while at the same time it attempts to lay a strong foundation for the future needs of pupils in the upper secondary school. Again, an initial trial with a small number of schools is followed by considerable expansion in successive years to other junior secondary schools until eventually all junior secondary schools will be involved. Pupils' books based on the new syllabus and adapted from the Scottish materials have been published for the first two years in English and Malay. Teachers have been provided with guide-notes, reference books, apparatus lists, specimen examination questions etc and a programme of in-service training has been mounted for this work in the same way as for the science programme.

34.3 Upper Secondary Level Having changed the programme in lower secondary science it becomes necessary to introduce a modern upper secondary level science programme. Since 1968 the development of a modified series of Nuffield-style O-level courses for physics, chemistry and biology has been under way. A series of in-service courses, writing sessions and practical work with trial materials have been organised and the trial materials for form 4 in the form of teachers' guides and pupils' work-books for physics, chemistry and biology were published in 1971 and the form 5 materials will be published in 1972. The initial trials of the form 4 materials commenced in 1972 and initial trials of year 5 will begin in January 1973. The materials developed are intended to provide a balanced course for two years forming a natural extension to the course at the lower secondary level. A considerable programme of in-service training has already been commenced in connection with the implementation of the new upper secondary courses and this will be expanded as further schools take to the new courses. At present initial trials will be in 29 schools scattered throughout Malaysia.

In the upper secondary mathematics field it has been decided that the basis for study shall be the Cambridge Overseas School Certificate, syllabus alternative C, which is a modern mathematics syllabus and a programme to develop teaching materials for this in Malaysia will commence in 1972 in time to provide materials for the first groups of pupils emerging from the lower secondary schools in 1972, having had courses in modern mathematics based on the Scottish adaptation. The first in-service course and writing session for this work will take place in July 1972.

Extensive assistance has been given to the development of these courses by the Overseas Development Administration of the United Kingdom, the Scottish Education Department, CEDO and the British Council through teacher vacation courses and other in-service courses. An activity of particularly vital importance assuming greater and greater significance is that of evaluation and a special course in this will be supervised by Mr J C Matthews of the University of Lancaster in March 1972. The primary mathematics and science work has received the assistance of an officer under the Aid to Commonwealth Teaching of Science scheme, Mr J Breakell, and proposals are at present being implemented to provide further assistance under the Aid to Commonwealth Teaching of Science scheme to the upper secondary science and the upper secondary mathematics developments. In addition, a considerable number of senior Malaysian personnel have been assisted to visit Britain both for active writing sessions with the assistance of UK consultants as well as for

more detailed orientation and training in modern science teaching methods to provide a cadre of senior experts in this field who can supervise the on-going implementation and further development of this work.

35. NEW ZEALAND

Education in Change

The New Zealand Post-Primary Teachers' Association, published by Longman Group Limited, price £1.00.

This is a report of their Curriculum Review Group with a foreword by Sir John Newsom. The publication is the result of a study set up by the New Zealand Post-Primary Teachers' Association following their annual conference in August 1966.

A special committee was set up with Mr R G Munro from the Auckland Secondary Teachers' College as its chairman.

The report itself divides its work into seven sections entitled:

35.1 A basis for judgment, in which the committee places highest value on "the urge to enquire, concern for others, and the desire for self-respect". The report goes on to study:

35.2 The nature of change in society and the challenges that change produces for education.

35.3 A pattern of values, both human values and their relevance for school practice.

35.4 Learning and enquiry with a study of cognitive objectives.

35.5 The measurement of objectives, with particular attention to the evaluation of growth.

35.6 The curriculum, with a particular study of the balanced curriculum, and

35.7 The interaction between the school and the community and the need for new communications to meet new demands.

The report does not in fact touch on the question of teacher training for the new age and it is suggested that a further volume on this should follow. The book closes with an interesting bibliography on modern educational development confined simply to science education.

36 NIGERIA

VIth Form Science Teachers' Courses

A VIth form Science Teachers' Course was held at the International School, Ibadan, Nigeria from 2-8 January 1972. The course was organised by the British Council in association with the Federal Ministry of Education in Nigeria. The objectives of the course were to enable teachers of VIth form science subjects to keep abreast of current developments in their field with regard to both change in content in the new West African Examination Council syllabus and a change in emphasis and methodology in testing techniques. The course was

divided into three sections - biology, chemistry and physics. Seven tutors took part in the course and one of these tutors Mr Colin Wood-Robinson of the Department of Education, Leeds University, was sponsored by the British Council as a specialist tourist to act as the biology tutor for the course. 70 people attended the course. Further information about the course and the proposal for courses in the future can be obtained from the Science Education Officer, The British Council, PO Box 3702, Lagos, Nigeria.

37. SWAZILAND

Secondary Mathematics Course, January 1972

A secondary mathematics course was held at the Swaziland Agricultural College in the University Centre, Luyengo, from 3-14 January 1972 and was attended by 74 teachers, 16 from Botswana, 31 from Lesotho and 27 from Swaziland. The purpose of the course was to work through the SMP books which the teachers would be using in the following academic year. The course was divided into three groups: Group 1 covered books A and B; Group 2 covered SMP books C, D, E and F, and Group 3 covered SMP books G, H, X3 and X4. The participants chose a group to meet their needs for the coming academic year. Opportunity was given to participants to address the course and express their views and experiences in the teaching of modern mathematics. The teachers also spent their spare time making teaching aids and classroom displays for a final exhibition. The British Council sponsored Mr R W Strong of Rydens school in Surrey to join the team of 10 lecturers.

38. THAILAND

Institute for the Promotion of Teaching Science & Technology

This project, which is supported by the United Nations Development Project Special Fund will have a duration of 8 years consisting of a 2 year preparatory phase and a 4 year full project phase. Its purpose is to assist the Government of Thailand in establishing the National Institute for the Promotion of Teaching Science & Technology in Bangkok. The basic organisation of the National Institute which began in late 1970 is now complete and the development of prototype curriculum materials is well under way. In the second phase increasing attention will be given to trials of these materials, the training of personnel and the implementation of materials in the school. The project has undertaken the development and production of prototypes, improved and modernised programmes of materials in teaching science and technology and will undertake the propagation of the improved science and technology programmes in educational systems and institutions. It will also undertake the revision of examination materials and procedures in implementation in the school system and the promotion of training and upgrading of professional technical personnel in the teaching of science and technology in Thailand. The courses being produced at present cover chemistry, physics, biology and mathematics for the science streams of the upper secondary schools, general science and mathematics for the art streams of upper secondary schools, science and mathematics courses for vocational and technical students in the upper secondary schools as well as general science and mathematics for the lower secondary school. The curriculum materials of each level will include class texts, laboratory guides, teachers' guides, supplementary reading materials, visual aids, laboratory equipment and appropriate testing and evaluation materials. It is envisaged that an extensive programme of in-service training will be required to reorient teacher approach in the classroom, to ensure that they have a sympathetic attitude to the new teaching

approach and to ensure that they understand the subject matter and to ensure that they know how to use all the new materials, including the visual aids and new laboratory equipment. A comprehensive and detailed plan for the trial and implementation of the materials has been drawn up beginning in March 1972 in order that the first material should be tried out in schools beginning in May 1972. This programme will then gradually expand through the various terms of the various years through 1973 and 1974 with continuous feedback of material and evaluation. The chief professional adviser to this project is Professor G H Aylward, formerly of the University of New South Wales where he was involved with the Approaches to Chemistry project, and who has extensive experience in science development in South East Asia.

39. UGANDA

A Chemistry conference entitled 'A Modern Approach to Chemistry' was held for VIth form teachers at Makerere University from 30 December to 16 January. The British Council sponsored the visit of Professor G M Hills in order that he could take a major part in this workshop conference. Professor Hills gave three lectures and also acted as Chairman of the conference on several occasions. A total of 18 lectures were given by university training college staff and visitors; five discussion group sessions and three practical sessions each of three hours duration took place. In addition there were three film sessions in the evenings and a book and apparatus exhibition. 60 teachers and training college students took part. This was the first conference at this level to be held in Uganda and, despite the very heavy programme, was most successful. Its purpose was to introduce VIth form chemistry teachers to the relatively new Cambridge T syllabus in chemistry. It should generate a demand for further short courses on specific topics of interest to VIth form teachers, the first of which is planned for September as part of the RIC (East Africa) conference. A limited number of copies of a report have been produced and further information may be obtained from Mr J Freeman, Department of Education, Makerere University.

40. UNITED STATES OF AMERICA

American Association for the Advancement of Science

The December 1971 edition of the Science Education News published by the American Association for the Advancement of Science is devoted to reports of 14 science teaching societies in the USA. In common with science teachers' associations elsewhere in the world these groups are contributing in important ways to the improvement of science teaching. The Associations listed are:

The American Association of Physics Teachers

The American Chemical Society

The Association for the Education of Teachers in Science

Federation for Unified Science Education

The Mathematical Association of America

The National Association of Biology Teachers

The National Association of Geology Teachers

The National Association for Research in Science Teaching

The National Council for Social Studies

The National Council of Teachers of Mathematics

The National Science Supervisors' Association

The National Science Teachers' Association

The School Science and Mathematics Association

Full details are contained in the Newsletter referred to above which is obtainable from the American Association for the Advancement of Science, 1515 Massachusetts Avenue NW, Washington DC 20005, USA.

41. ZAMBIA

The address of the Zambian Association for Science Education is now as follows:

Zambia Association for Science Education
Box RW 335
Ridgway
Lusaka
Republic of Zambia

INTERNATIONAL ACTIVITIES

42. UNESCO Regional Seminar on Science Education in the Arab States

This Seminar was held at the Ain Shams University, Cairo and its aims were as follows:

Firstly, it was organised to exchange information amongst participants on the nature, scope, organisation and status of science education in the Arab States, the character, duration and results of specific science education improvement activites in the region, the nature, operation and products of recent major science education improvement projects around the world, the kind and amount of resources within the region for undertaking further national regional science education improvement efforts, and the types of international bilateral assistance available for science education improvement.

Secondly, it aimed to exchange ideas amongst participants on the importance of and priorities to be attached to science education improvement, the nature of the process of innovation in science education, particular problems in making improvements in specific disciplines, and an analysis of particular cross-disciplinary problems, eg the training of teachers.

Thirdly, the Conference aimed to prepare a regional plan of action for science education improvement including appropriate recommendations for future separate and collaborate activities by science teachers and their associations, by national authorities and agencies, by regional bodies, by UNESCO and other international organisations.

There were about 40 participants representing a number of member States of UNESCO in the Arab world, including Bahrain, Iraq, Jordan, Kuwait, Lebanon, Libya, Qatar, Saudi Arabia, Sudan, Syria, Tunisia, the Yemen Arab Republic, The People's Democratic Republic of Yemen, Morocco, as well as the Arab Republic of Egypt. In addition there were representatives from Cyprus, Iran and Turkey. There were also a number of observers, including representatives from UNESCO field office of science based in Cairo. In addition a number of specially invited consultants from outside the region, some of them UNESCO experts from other parts of the world, also attended.

A number of lectures on topics such as 'Science education improvement in perspective', 'The integrated approach to science teaching', 'Evaluation of science education', 'University science education' were given. In addition there were two sets of workshops, one devoted to the subject matter of science education (biology, chemistry, physics, mathematics and integrated science) the other concerned with cross-disciplinary topics such as teacher-training, aims and objectives in science education, evaluation and learning materials.

The official report of the seminar will be available in due course and will contain the principal conclusions and recommendations of the individual working groups and of the conference as a whole. These conclusions and recommendations will include a number of proposals for follow-up activities in the form of seminars centred in the area of examinations as well as possible regional activities. The report will be available from UNESCO Division of Science Teaching, Place de Fontenoy, Paris 7e, France.

43. SOME FORTHCOMING INTERNATIONAL SCIENCE AND MATHEMATICS EDUCATION CONFERENCES

Date 1972	Title of Conference	Location	For Further Information Contact
17 April - 20 April	Educational use of Living Organisms (Institute of Biology in association with UNESCO and Chelsea Centre for Science Education)	London, UK.	Centre for Science Education, Chelsea College of Science & Technology, London SW6, UK
29 May - 10 June	Asian Expert Seminar on the Development of Science/Maths Concepts in Children	Bangkok, Thailand.	UNESCO Regional Office for Education, in Asia, POB 1425, Bangkok, Thailand
11 June - 17 June	Expert Meeting on Science Teachers' in South-East Asia	Singapore.	UNESCO, Division of Science Teaching, Place de Fontenoy, Paris 7e, France
20 July - 26 July	International Congress on Teaching Physics to Students in Physics Related to Sciences and Professions. (International Union of Pure and Applied Physics)	Kiel, Fed. Rep. of Germany.	Prof Dr W Kœbel, Institute for Applied Physics, University of Kiel, Olshausonstrasse 40-60, Bldg 34, 4-2300, Kiel, Fed. Rep. of Germany
31 July - 12 August	Sub-Regional Workshop on Integrated Science Teaching in South-East Asia	RECSAM, Penang, Malaysia.	UNESCO, Division of Science Teaching, Place de Fontenoy, Paris 7e, France
13 August - 18 August	Asian Association for Biological Education Conference	Jerusalem, Israel.	Prof Polyakoff-Mayber, Science Teaching Centre, Hebrew University, Jerusalem, Israel.
29 August - 2 September	2nd International Congress on Mathematical (International Commission for Mathematical Instruction & International Mathematics Union)	Exeter, UK.	Hon Sec, ICMI Congress, Dept of Education, Thornlea, New North Road, Exeter EX4 4JZ, UK.
3 September - 16 September	International course on Curriculum Developments in Secondary Science (The British Council in association with the Chelsea Centre for Science Education)	London, UK.	Local British Council Representatives OR Courses Dept, The British Council, 65 Davies Street, London W1Y 2AA, UK.

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Date	Title of Conference	Location	For further information contact
1972 contd			
21 September - 29 September	Symposium on School Technology Studies (Council of Europe in association with the British Council and the Department of Education & Science) (Delegate participation by Government invitation - observers permitted.)	Nottingham, UK.	The Secretariat, Council of Europe, Strasbourg, France, OR Courses Dept, The British Council, 65 Davies Street, London W1Y 2AA, UK.
August/ September	International Seminar on New Methods of University Science Teaching	Latin America.	UNESCO, Division of Science Teaching. Place de Fontenoy, Paris 7e, France.
September	Workshop on Science Teaching Equipment for Asia	New Delhi, India.	" " " "
28 September - 30 September	Asian Regional Seminar on the Promotion of Public Understanding of Science & Technology	Manila, Philippines.	" " " "
September/ October	Workshop on Integrated Science Teaching in Latin America	Sao Paulo, Brazil.	" " " "
23 October - 3 November	Expert Seminar "Strategies for the Improvement of Education in Science and Mathematics" (UNESCO in association with the British Council, CEDO and the Chelsea Centre for Science Education)	London, UK.	" " " "
December	Regional Seminar in Science Education Improvement in Latin America	Santiago, Chile.	" " " "
1973			
3 April - 13 April	Education of Teachers for Integrated Science (International Committee for Scientific Unions)	Maryland, USA.	Science Teaching Centre, University of Maryland, Maryland 20742, USA.

Date 1973 contd	Title of Conference	Location	For further information contact
September	Symposium on an Integrated Science Curriculum for the Upper Secondary School (Council of Europe in association with the British Council and the Department of Education & Science) (Delegate participation by Government invitation - observers permitted)	Exeter, UK.	The Secretariat, Council of Europe, Strasbourg, France.

In addition a UNESCO-sponsored Regional Workshop on Science Curriculum Development in Asia is being planned for the latter part of 1972 to be held in Japan, and in 1973 the Commonwealth Education Committee will be organising a specialist Commonwealth Conference on Teacher Education.